ORAL HISTORY PROGRAM

Jose Rodriguez-Ibabe: Devotion to a Life of Service in the Steel Industry - Pushing the Limits of Metallurgy

2023

PREFACE

The following oral history is the result of recorded interviews with José Rodriguez-Ibabe conducted by Pello Uranga on June 21, 2022. This interview is part of the AIME Oral History Program.

ABSTRACT

Jose Rodriguez-Ibabe has had an admiration for engineering since his childhood in Renteria and San Sebastian, Spain. Under the guidance of his father and an encouraging family friend, Rodriguez-Ibabe was accepted into university and became the first in his family to achieve higher education. His time in school led him from mechanical engineering to fracture mechanics and metallurgy. Rodriguez-Ibabe was on a path of ceaseless research and discovery as he went from being a PhD student to a researcher at the CEIT Research Institute. From then on, he and his team worked tirelessly to research fracture mechanics and the fatigue and brittle properties of steels. Their work brought them success and recognition at conferences worldwide, and they became the recipients of many prestigious awards, such as the Vanadium Award from the Institute of Materials and the Meritorious Award from the Iron and Steel Institute. He is also the author of the book *Thin Slab Direct Rolling of Microalloyed Steels.* Today, Rodriguez-Ibabe continues to research and discover new ways of improving industry, primarily through his work identifying heterogeneities in the microstructure of steel during hot rolling. Learn more about his extraordinary career and the message he has for new engineers in his oral history.

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00:00 INTRODUCTION

Uranga:

Hi, this is Pello Uranga. I'm Researcher and Associate Director of the Materials and Manufacturing Division at CEIT [Centre for Technical Research] Research Institute in San Sebastian, Spain. Today is Tuesday, June 21st, 2022. We are here at CEIT with our guest, Professor José Rodriguez-Ibabe, current Executive President and Researcher at CEIT. He was actually my PhD advisor, and we have been working together for the last 25 years now. This recording is a part of AIME's oral history capture program, and this interview will be recorded by BCC Live using their Riverside software.

So, let's start jumping back in time to your childhood, or the school history, and how the interest in engineering started, in your case. So, just to start with, can you tell me about where you grew up, and what did your parents do for a living?

01:11 MY CHILDHOOD AND EARLY EDUCATION IN SPAIN

Rodriguez-Ibabe:

Well, first, I would like to thank AIME and also AIST [Association for Iron and Steel Technology] for giving me the opportunity to take part in this program of oral history. And also, I need to thank all the people involved in the technical assistance to this video.

Well, starting out my life, I was born in San Sebastian — San Sebastian is located in the Basque country in the coast in the north of Spain — but, my first nine years I spent in a small town called Renteria. My father worked as an administrative in a manufacturing company, and my mother was a homemaker. I will say that this part of my life was, the childhood, quite normal. I went to school, and I just played soccer and other sports. Those days I was quite bad playing a sport, so my friends didn't want to invite me to be part of their team, and, perhaps, this is why I am not so convinced to do sport nowadays.

After nine years, we moved to San Sebastian. And, I will say, when you asked me about when I started thinking about engineering, I think that perhaps when I was 13 or 14 years old, my parents were told by the teacher that I was good in math and, later on, in physics and chemistry.

Based on this, my father started advising me as to why not go into engineering, why not study engineering. And, I remember that he had a friend, that he was an engineer, and he invited him, my father invited him, just to talk, to have a chat with me about what happens in the professional life of an engineer. Later on, when I was [an] engineer, several times I met this engineer, a friend of my father. We laughed several times remembering about this initial talk. I must also say that I was the oldest of three children, but considering all the family, the big family, I was the first one, the oldest one, and also the first one that had the opportunity to go to university. Nobody in my family went first to university, and perhaps this was also the reason why my parents and their family were so interested in what happened this initial time.

04:13 A LAST-MINUTE DECISION

Uranga:

Okay. So, in that moment, which was the school or the university that you chose, and why did you choose that school?

Rodriguez-Ibabe:

Well, in those days there was some very [good] engineering schools, a school of engineering in Spain and one of them was located at the University of Navarra. And, I chose [it] as a first option. It is true that in the moment I was thinking also to study chemistry, but in the last moment I decided to go to engineering. So, I will say that the decision was quite clear, and I decided to start engineering. In those days in Spain, engineering was followed by five years. The first two were common [studies], and it was necessary to choose specialization in the third year; and, I considered to do mechanical engineering. So, I am a mechanical engineer from this point of view, and I will say that metallurgy was not included in my first option. And, in fact, there was not this specialization in this school in those days. Initially, when the school was opened, yes, but the metallurgy like that disappeared. There was an important department of metallurgy in the school.

05:42 APPROACHING THE METALLURGY DEPARTMENT AS A YOUNG MECHANICAL ENGINEER

Uranga:

Yeah, so I'm sure that after the initial years of the engineering studies, you met some professors or mentors that led you in this particular way?

Rodriguez-Ibabe:

Yes, that's right. In fact, when I think I was starting the fourth year, Professor Fuentes — he was the head of the metallurgy department — called to me and just invited to collaborate in the department. For me, [this] was a surprise, because he didn't know me. He was not my professor, but I suspect that another professor convinced him, or gave him my name, just to try to convince me. Professor Fuentes, initially, he proposed me to work in the field of fracture mechanics, not only to collaborate in the last years of engineering but also to do the PhD thesis in his department. I suspect that he proposed [to] me fracture mechanics because, for a mechanical engineer, it was quite, I will say, [a] normal topic, and it was not so close to metallurgy. So, perhaps he was thinking that it would be easier for me to say yes, if there was something related with the mechanics and not with metallurgy. And, on the other hand, this was [the] later seventies, and fracture mechanics was one of the hot topics that was present in the metallurgical department in those days. So, both things [were] exciting for one part because I was a mechanical engineer and, on the other side, because they were interested in fracture mechanics. They proposed me to approach the metallurgy department in this direction.

07:40 JOINING THE METALLURGY DEPARTMENT – A PIVOTAL MOMENT IN MY PROFESSIONAL LIFE

Uranga:

And, in your particular case, was it clear from the very beginning that your more, let's say, professional career was led into the research world, or did you have your doubts or your other different thinking about that?

Rodriguez-Ibabe:

In fact, I was not thinking to do a doctoral degree. My initial idea was to finish the engineering and just to graduate and go directly to industry. So, it was something different, I will say, this proposal [was]. And, when I have said [yes to] that, it is clear that all my professional life had changed completely. In those days, something special was happening in the department, in the metallurgy department, and some people that were from outside Spain came back to the department, for example, Professor Fuentes. He made the PhD thesis in Sheffield University in England. My advisor in the thesis, that was Professor Gil-Sevillano. He was formed in Leuven University in Belgium. When they returned to Spain, they returned with new ideas about how to work, how to perform apply research, how to collaborate with industry. And, to do this, they were looking to create a team with young engineers, and they were looking for young people just to take part of this project. So, I think it was a moment in which they were very interested in having young people in the department, and I was arriving in this moment. I said yes, and it was a very important moment in my professional life, of course.

09:35 A STUDENT ONE DAY, A RESEARCHER WITH THE CEIT RESEARCH INSTITUTE THE NEXT

Uranga:

So, I understand that now we have reached after your PhD, or even the last step of your PhD. We have reached to the point where [you make] the transition from studies or university before graduating and then entry into the profession. So, linked a little bit to that topic, can you describe a little bit [about] which were the first projects that you were dealing with in the research center, and how was your job during those days?

Rodriguez-Ibabe:

Yeah, just a little bit before perhaps, Pello. I remember when I finished, well my thesis was in the field of fatigue crack propagation in medium carbon ferrite=pearlite steels. And, when I finished the thesis and we submitted a manuscript to an international conference, it was the International Conference on Fracture [ICF] in India, in New Delhi, and I attended. It was my first international conference, and when I was there, and I saw some important — for me — important figures, important professors in the field of fracture mechanics, such as John Knott, R.O. Richie, W. Gerberich, orAndré Pineau. I realized that, well, this looks [like a] very interesting professional life. Why not follow this? I will say, these stars in fracture mechanics, and, in all the cases, they were not only related to fracture mechanics, they also had a metallurgicall point of view. This is also very clear in the case of Knott and Ritchie and also Pineau. Pineau, he's a metallurgist. So, this combination [appealed] a lot to me. I must recognize this. So, I finished the thesis, and they proposed me to be a researcher in CEIT Research Institute. This institute opened two years before I finished the thesis.

And, in fact, it was a spinoff of the School of Engineering. So, I accepted, and the situation was a little bit very nice because I finished my thesis one Friday, and the following morning I was working in the materials department of [CEIT]. So, I didn't have time to make any change. I went directly from one, I will say, from a student in the last moments of the thesis to a researcher in an institute that was created to perform the applied research. This was the situation. When you asked me about the first project, I remember it was a mix again between fracture mechanics and metallurgy. It was a European-funded project about fracture mechanics, fracture behavior of bainitic steels. And, in fact, [what] the steel we were studying was a nuclear steel, A533B, A five, three, three B. And, I remember that I was involved, not only in the tests, mechanical tests, just to identify or to quantify the ductile to brittle transition but

also [to] look in the microstructure and look in the features, the microstructural features that were intervening in the fracture behavior. So, it was a balance between these two situations: fracture mechanics and metallurgy.

13:15 LISTEN AND TRY TO UNDERSTAND — ADVICE FROM MY MENTOR

Uranga:

Yeah, and, in that moment, I know from, well, from yourself, that you have mentioned Professor Fuentes, you have mentioned Professor Gil-Sevillano, once living during your PhD. Then, I know that also Professor Urcola was one of the, let's say, mentors in those first years at CEIT Research Institute.

Rodriguez-Ibabe:

Yes, that's right. In fact, Professor Urcola, he was the head of materials department at CEIT, and I remember he was formed also in Sheffield University. And, I remember that once we were speaking, and he told me, “You are always performing tests to see how steel breaks. Why do [you] not start looking how to avoid the fracture of the steels? Why do you not start looking at the microstructure, and try to modify it?” So, he was pushing me to the side of metallurgy, to the side of physical metallurgy. I accepted; and, it was, again, a big change in my professional life, because slowly, slowly, I went more and more to the metallurgical aspects to try to avoid fracture behavior, as Urcola mentioned, or invited me to go in this direction. And, I would like also to mention that Urcola for me was a very, very important person. He was very involved in activities with industry, steel industry, and one of the things he liked to say is, well, “When we go to a steel plant, and they have a problem, and we don't understand this problem, and we assume that this is not metallurgy, from the point of view, metallurgy doesn't make sense, you don't say no. You listen again, and you try to understand what is happening, because. if this happens in the plant, this is real, and we need to consider it.” And, just this idea of listen to what is happening in the plant, listen to what professional engineers from the steel plant are telling us, listen and try to understand, has been one of my motives of my professional life. So, this idea of Professor Urcola to listen [to] the professionals of the steel plants and try to understand and try to, as a first step, to understand, and after, to try to modify, to try to improve or to do something, has been one of the characteristics I try to apply in all the research activity I have been involved with in industry.

16:01 AT THE ELECTRICAL FURNACE PLANT – ONE OF MY FIRST EXPERIENCES WITH APPLIED RESEARCH

Uranga:

Yes. So, as far as we are listening to now in this professional development, after the first steps in your professional career, there was a clear transition from a more academic or more public-funded research towards more applied research in industry and with working with the steel plants here in our region. So, I'm sure that you can share some additional examples of that with us.

Rodriguez-Ibabe:

Yeah, that's right. Well, my first project with Professor Urcola was with a local steel plant, which I was involved with.. And, I remember we went to the plant, it was electric furnace, an electrical furnace plant, and they work, usually, at night because the electricity was cheaper. So, I remember the first time we

visited the plant, it was 1 a.m. or something like that, because it was the moment in which the furnace was working and continuous casting also, and we had to visit and to see everything. So, this was one of my first experiences; 1 a.m – 2. a. m. in a steel plant. And the project was related with wirerods. Because it was a scrap-based steel the nitrogen level was very high, and they had some problems concerning the drawability of the steels. And, I remember that we proposed to add boron to fix this nitrogen, and the results were very, very good, of course. This is something that we know perfectly, but this happened 40 years ago. So, it was my first experience interacting directly with professionals of a steel plant, trying to understand the limits that they have and try to help them. It was a very, very good experience for me.

17:58 EXCITING DISCOVERIES AT THE BULGARIAN CONFERENCE ON FRACTURE

Uranga:

Okay. So, we have been talking about the first industry-related projects in your research career. I know that from — and connecting with the fracture mechanics that you have been commenting [on] before — there was one point where you transitioned or you went deeper into the fracture mechanics, in terms of the effect of titanium and the titanium nitride particles. Can you comment a little bit more on that topic, please?

Rodriguez-Ibabe:

Yes, of course. In fact, I continued working on fracture mechanics, and I prepared maybe two or three contributions for the European Conference on Fracture that had to be held in Yugoslavia. It was 1992, and the civil war just started, and the conference in the last moment moved to Bulgaria. I went to the conference, and I will say it was a very strange situation because a lot of oral talks were canceled, and other new presentations appeared in the last moment trying to fulfill the program. And, some keynotes also extended significantly over the initial schedule. In this context, I remember that Professor Knott from Cambridge University explained that and showed that in some cases oxide particles can be responsible for the brittle process in steels, and I came back to CEIT with this idea. And, in that moment, we were working in a project for the forging steel that they were introducing titanium microalloying to avoid the posterior heat treatments just to control austenite grain size. And, they had some problems concerning fracture mechanics — minimum toughness requirements. I thought, well, perhaps these coarse titanium nitride particles, may be also responsible of brittle process, of the start of a brittle process. And, I don't remember exactly, but perhaps I spent two or three working days in the scanning electron microscope looking at fracture surfaces and trying to identify the origin of the brittle process and if there were not titanium nitrides in this origin.

At the end, there were, and I identified one of them; and, just observing the first one, I was able to do the analysis quite quick. We had a meeting, I remember, with Professor Urcola, and we just realized that we were in a very interesting situation. Titanium nitrides are formed at very high temperature, and they remain stable when we are performing heat treatments. So, this means that we were able to modify the microstructure of the steel but remain or maintaining constant the brittle particles, the titanium nitride particles; and, this was completely different from what happened when we have carbides. Carbides also can be the origin of brittle fracture, but when we modify the microstructure, we also modify the carbides; and, this was not the situation. So, we performed several analysis and different works; and, they were published in, I think, two or three papers in an international journal of metallurgy. And, the question was that these papers were read at the international level, and one of the persons was Paul

Repas, Paul Repas from U. S. Steel. He was involved in one of the technical committees of the Iron and Steel Society, and he was organizing a symposium inside the Mechanical Working and Steel Processing Conference concerning fracture and microstructural behavior of steels.

And, he invited us to take part in the conference with a contribution. I went, and I presented an oral paper on our contribution in the Mechanical Work and Steel Processing Conference [(MPSP)] in Baltimore in 1994. This was my first interaction with the Iron and Steel Society, and the question is that this conference also was attended by George Krauss from the Colorado School of Mines; and, he was organizing a conference for the following two years in '96 about microalloying and forging of steels. He invited us to submit an abstract and to submit a presentation. So, in '96, I attended the conference — and I have here the volume. This one for me was a very, very important conference because I met for the first time David Matlock and all of the team of the Colorado School of Mines in Golden. And, well, I realized that it was possible to have connections with other research groups in the frame of the conferences organized by the Iron and Steel Society. So, I think it was very, very important this initial conference in Bulgaria and the work we performed in the lab about the titanium particles, fracture mechanics, and microstructure, and how this was presented in two conferences organized by the Iron and Steel Society.

23:25 CARRYING ON IN THE FACE OF DISASTER

Uranga:

I think that this is a great example of [an] industry-oriented research piece of work, translated into a, let's say, success in the more scientific field, and how these type of examples could enhance the networking and the contact of different research groups. This is a nice and a positive example, but I am sure that during this whole career there also have been, let's say, more negative or bigger challenges in your career, and I would like you to comment on one of those examples, please.

Rodriguez-Ibabe:

Yeah. In fact, this year, '96, was a very bad year for us. Professor Urcola died in a bicycle accident. He was on vacation, on holidays, and he just had a traffic accident, and he died. So, from one day to another, we were involved in a huge number of projects because he was very, very active, and he had several projects running at the same time. He was not here, and we had to follow his work. My colleague, Isabel Gutierrez, took the responsibility of the team at that moment, and I took more of those projects related with industry, which Urcola was working in that moment. So, it was very, very hard for us because he was not only the head of the department, the head of the group, he was also a big, big friend of mine, and everything for me; and, this was, I would say, nearly a disaster in that moment. The question was that he left a very goodteam, I will say, looking at the trajectory. And, we were able to continue his activity, his work.

The other person involved in the team was Beatriz Lopez. And, I'm sure that those who know us — Isabel, Beatriz and me, and the team —in the last 20, 25 years have been working and have been, I will say, the face of this group in a lot of conferences and contributions. Theteam, I will say, started working in '96 as a consequence of this tragic event. And, in fact, two years later on, in '98, we organized a conference — I have here the book also: *Microalloying in Steels,* devoted to the memory of Urcola. It was an international event. I think it was quite good, and I didn't realize in that moment, but after that, I think, because all the teams worldwide realized that we were very, very involved in the field of

microalloying related with thermomechanical processing of steels and so on. We appear as one of the teams that, well, they perform some interesting work that could be applied in industry in several places. So, I will say that in '98, with this conference, changes appeared also in our team, and we became more and more international.

26:42 A BIG, BIG HONOR — WINNING AWARDS AND GAINING WORLDWIDE RECOGNITION

Uranga:

Yeah. And, based on those, and in this transition to a higher international activity and higher scientific relevance, I know that you received several awards, international awards. Could you share those experiences with us, please?

Rodriguez-Ibabe:

Well, in fact, they are related with the Iron and Steel Society at the beginning. Once [I] attended the conference in Colorado, I decided that I had to send, every year, some contribution to the Mechanical Working and Steel Processing Conference. So, for me, this conference was very, very interesting in the field of the activities I was involved in, in those years. So, I started sending every year a contribution, and in ’99, I think it was in Baltimore, the conference, we prepared a talk about the Vanadium microalloying in warm forged steels. And, the question is that this manuscript received a Meritorious Award of the Iron and Steel Society, and it was our first international award. So, I was, in fact, very, very happy first, and second, I realized that it was possible to share some of the research that we were doing in our lab with the help of the Iron and Steel Society; [it] was possible to share in an international, I would say, arena and just all people recognized our work, also. So, this was the first one in 1999, yes. Some of this work also concerning Vanadium microalloying in warm forged steels we published a paper in an international journal, and this paper received, in 2001, the Vanadium Award from the Institute for Materials. So, it was, I will say, our second international award; but this award, just as an institution, it was the Institute of Materials.

For us, it was a big, big honor. After that, in 2001, also in the mechanical work, in a steel processing conference, we presented a manuscript about the microstructural heterogeneity or how to avoid microstructural heterogeneity in niobium microalloyed steels produced following thin slab and direct rolling technology. And, in fact, Pello, you were one of the co-authors of this work. And, the question is that this manuscript received, two years later in 2003, the Charles Hatchett Award now from the Institute of Materials, Minerals and Mining — I mean it was the same as the previous one; it merged with another two institutions, and it became the name that it is the official now Institute of Materials, Minerals, and Mining. This Charles Hatchett award, in fact, it is the niobium award. So, if you realize in a short time, we have some interesting activity done with titanium microalloyed steels, later on we received an award in the frame of Vanadium microalloying and now niobium microalloying. So, this means that we became more and more active in the field of microalloying in steels and also that our work was well-recognized worldwide. I think these are the main points, and just take into account that also this Charles Hatchett Award was presented in the context of a conference organized by the Iron and Steel Society.

30:29 BIG CHANGES IN INDUSTRY AND NEW APPROACHES TO MICROALLOYING

Uranga:

Yes. I mean, this evolution, this led you also to organize a second microalloying conference later in 2005 --a little bit summarizing or highlighting this experience in the different fields of microalloying.

Rodriguez-Ibabe:

Yes, that's right. And, the conference, I think, was a quite interesting one with some important contributions in those days in the field of new approaches concerning microalloying and new applications of these microalloyed steel grades. Well, in fact, it is very nice also because in the conference we organized in '98, the talk, the keynote talk, I made was about fracture mechanics and microalloying; and, in 2005 my talk was about microstructural heterogeneity or how to reduce microstructural heterogeneity in thin slab technology. So, it was a change that also summarized the changes that were happening in the type of activity I was doing for industry. And, in fact, for this conference, or for this manuscript, I accumulated, I will say, a lot of work. And, with all this data I have, I prepared a book that was published in 2007, just the *Thin Slab Direct Rolling of Microalloyed Steels*. It was, I think, the first book devoted to this specific technology. Thin slab direct rolling started in the United States, in fact, at Nucor, and it was spreading worldwide in 2000, at the beginning of the 2000.

32:28 HOW I INTERACT WITH INDUSTRY AND STAY INVOLVED WITH AIST

Uranga:

Yes. And, this last book was, I mean, one of the examples of this evolution. And, I mean, we are not arriving to the end yet, but before arriving to the end, and also acknowledging this opportunity that AIME and other, let's say, sister societies are offering us to run this interview, we would like to know a little bit more about your involvement and your activities in the framing of the different societies, especially, in your case, AIST [Association for Iron & Steel Technology] but also with some activities in other associations. So, could you comment a little bit on that before reaching the end of the interview?

Rodriguez-Ibabe:

Yes. Well, I mentioned before that I decided to take part in the Mechanical Working and Steel Processing conferences and maybe you know that in a moment this conference merged with other conferences, and there was established the new big one in Materials Science and Technology, MS&T. From the beginning, we took part in all, I think, in all the MS&T conferences, in some other conferences organized by, specific conferences, organized by AIST, for example, long products or just plates, this type of more, I would say, specific conferences. And, looking [at] all the contributions, I think I have submitted close to 50 manuscripts to these conferences organized by AIST or TMS, also. In some cases, with oral presentations, but in others as a co-author. So, close to 50 presentations. And, just also to remember that in the last years we have received three times — or I received, and you Pello a fourth one — three times the Gilbert Speich award to the best physical metallurgy manuscript or paper. So, this means that we are very, very involved in AIST. Therefore, at least for me, it is a very good platform to share the research we are doing and also to collaborate and to have interaction with other groups and other industries.

But also, we have been involved in the technical committees. I remember I started attending the, I think it was the Long Product and Forging Committee in the Iron Steel Society, initially. When we moved to AIST also, I started taking part in one of the technical conferences, committees, sorry. And, I remember

that in a moment I couldn't attend one of these, and just I invited you, Pello, to go there. And, since that, you have been attending these meetings, and I will say that, at least from the last 20 years, always there is somebody from our group taking part in one of the technical committees of the AIST. Constantly, we are taking part because we think that it makes sense. It helps us also to have good relationships, help us to have some knowledge of what can be interesting for the industry in different, I will say, new activities or new research challenges. And, at the end of the day, I will say that looking what means AIST for me, and TMS also, is a good, good opportunity to have, I will say, a deeper or better professional activity.

36:20 THE LAST STEP IN MY PROFESSIONAL CAREER

Uranga:

Yeah. So, I think this is a nice example of how this type of society and membership can help us, and not just from the academic point of view but also the interaction with industry.

Okay, so you have been talking about the interaction with AIST and other societies, and I think that one of the relevant points here is your commitment and your involvement publishing a specific chapter with AIST. Can you comment on that, please?

Rodriguez-Ibabe:

Yes, that's right. I think it was in 2012 that I was invited by AIST to take part in the new volume they were preparing, the flat products volume of *The Making, Shaping, and Treating of Steel.* Big, I will say, book. For me was, first, a big surprise. Second, I was very, very happy, and, yes, I prepared a chapter concerning metallurgy of hot rolling. It took me quite a high number of hours; but, at the end, the product was very, very well published, and I am really very, very happy to be part of this nice project that it is this collection, I would say now, because it's not a book. There are several volumes of *Making, Shaping and Treating of Steel*. For me, it is something, as I will say, the Bible of the steels.

So, we are getting closer to the end of the interview, and maybe, just to wrap up, we have seen a clear evolution starting from the mechanical engineering perspective going towards fracture mechanics, understanding the metallurgical concepts, and then going a little bit farther into the microstructural homogeneity and processing control. So, can you comment about your, let's say, these last years of your activity and where you are, let's say, you have headed to in your research activities?

Just as you mentioned, the microstructural homogeneity is becoming more and more relevant because we are looking for, I would say, higher strength, better steels with more robust properties, and this is difficult. So, it's not easy at all from the production point of view. Maybe we started 20 years ago in the field of hot working — hot forging, and later on hot rolling. And, we developed equations. We developed tools just to understand and to predict how the microstructure evolves during all this hot rolling process. Ten years ago, a little bit more, perhaps, we started constructing models to help industry in this sense and seven, eight years ago we launched what we know now as a MicroSim model. It is a model, I think the first model, able to identify heterogeneities in the microstructure during hot rolling. Nowadays, we have several versions for plates, hot strip mill, sections, bars; and, I think it is approximately running these models in 17, 20 steel plants. This means that we are able to share our knowledge, our experience that has been accumulated by performing a lot of laboratory tests in a small scale. We have jumped into industry, jumped to industrial situations, and we can help industry in this sense. So, for me, it has been-- I am very, very happy for this opportunity we have had. And, this is not [only] my work, this is a

teamwork. So, it is all the team that we are in the thermomechanical processing group at CEIT, that we have been involved in this activity. And, I will say that is the last step in my professional life relating lab knowledge and transfer to industry.

Uranga:

Okay, so maybe I'll just ask the last question. Could you sum up your career in maybe two, three words, please?

Rodriguez-Ibabe:

Well, it's not easy. I would say that it has been a very, very interesting journey, very exciting journey of my professional life. Initially, it was not something that I considered with a plan well done. Opportunities arrived in different moments in my life, and I accepted these opportunities, and went on. But, looking back, I will say that there is a common point in all these activities, and this is the type of research I have been involved, and I think I have been doing research for helping the steel industry, or I will say doing research for the service of the steel industry. I think this is the main aspect I will summarize concerning what I have been doing, since I started in the middle eighties with my first professional projects with steel plants.

Uranga:

Okay. So, I don't know if there is anything else that you would like to share with us.

Rodriguez-Ibabe:

No. Perhaps.

Uranga:

Yes, please.

42:18 THERE IS A LOT OF WORK TO DO — ADVICE FOR YOUNG ENGINEERS

Rodriguez-Ibabe:

I would like to thank, again, AIME and AIST for giving me this opportunity to share with everybody what has been my professional activity. And also, I will say to young engineers that it makes sense. It is interesting to work on materials. It is interesting to work on, honestly. There is a lot of work to do, a lot of things to improve, and we can help in many, many ways. We can help, I would say, with many different options to the steel industry nowadays. But, what I am saying about the steel industry, perhaps we can repeat it with all the materials, the technological materials that nowadays we need as a modern society.

Uranga:

Okay. I do agree, too. Well, I think that this interview has reached the end. So, it's been a real pleasure to spend this time with you. I think that this interview reflects a brilliant research career, as you said,

supporting the steel industry and also pushing the limits of the physical metallurgy and trying to understand the mechanisms behind. So, thank you so much again for your willingness to share your story here with AIME.

Rodriguez-Ibabe:

Thanks also, Pello, for helping me in this interview.

Uranga:

Okay. Thank you.