Biography

Industry Background

- *Material Application Engineer* with GE Aviation
- *Technical Services Manager* with Bodycote

Role & Responsibility at Quintus

Application Engineering Manager for the Advanced Material Densification division focusing on Hot Isostatic Pressing (HIP).

Manages the *HIP Application Center* located in Columbus, Ohio, educates on the advancements of HIP technologies, and is involved in collaborative development efforts both within academia and industry.



Chad Beamer

Quintus Technologies LLC
Application Engineering Manager
chad.beamer@quintusteam.com
Tel : 614 404 3982

Global leader in high pressure technology since 1950s



Material Densification

The world's first high-pressure press

Largest Wire Wound HIP

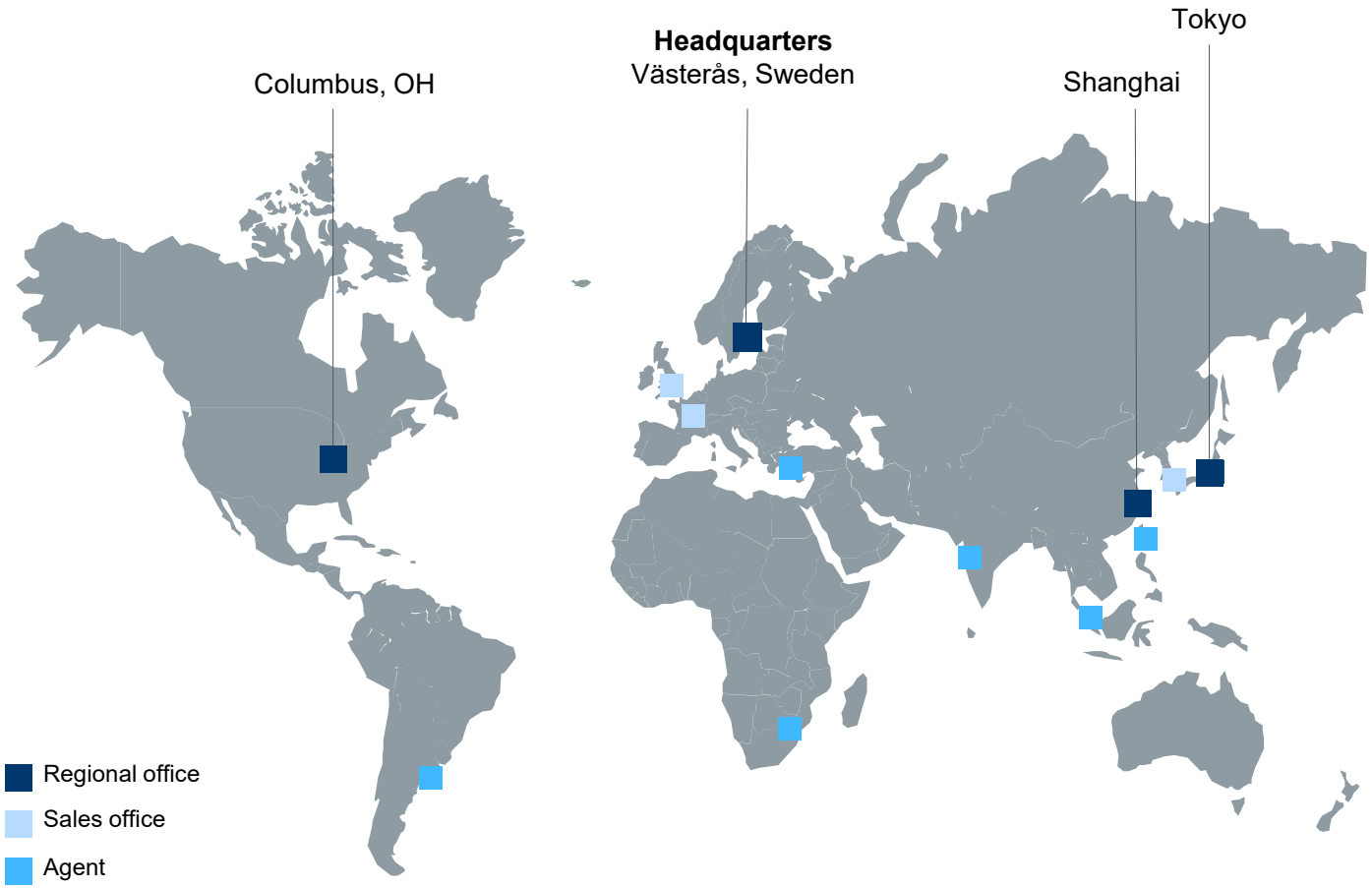


Largest Wire Wound CIP



Isostatic Laminator

Quintus at a glance



320
Employees

45
Countries

2,000
Systems delivered

120
Patents

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HIP & CIP Application Center



HIP Application Center – Columbus, OH



In-house application R&D

Gain knowledge about equipment in operation

Training and education on the equipment

R&D collaborations globally

Services include:

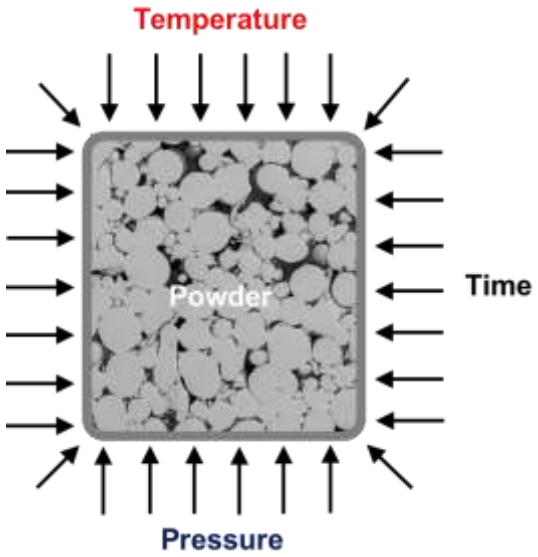
- Evaluation of new processes and applications
- Optimization of current CIP - Sintering - HIP processing
- Proof of concept for potential customers

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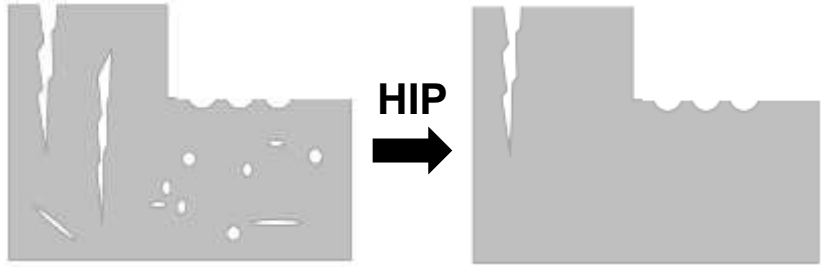
HIP Fundamentals: Process Chain

CIP to 600 MPa
HIP to 200 MPa @ 2000°C

- Powder preparation
  - Particle size and distribution, sintering aids, composite or grain boundary phases
- **Shaping of green body**
  - **Binder volume and distribution, particle agglomeration, final green density,(cast, CIP, etc), green machining**
- Thermal de-binding (grey body)
  - Vacuum, hydrogen or air atmosphere
- Sintering to minimum a gas tight state (generally to >93-95% of TD)
  - Vacuum or atmospheric pressure
  - Liquid, gas, solid state, reaction sintering
- **HIP to near full density using Temperature, Pressure and Time**
  - 1400°C (nm grainsize Alumina) - 2000°C (low sintering aid SiC)
- Finishing, surface grinding and polishing
  - Surface defects are the main strength and reliability limiting factor for brittle materials

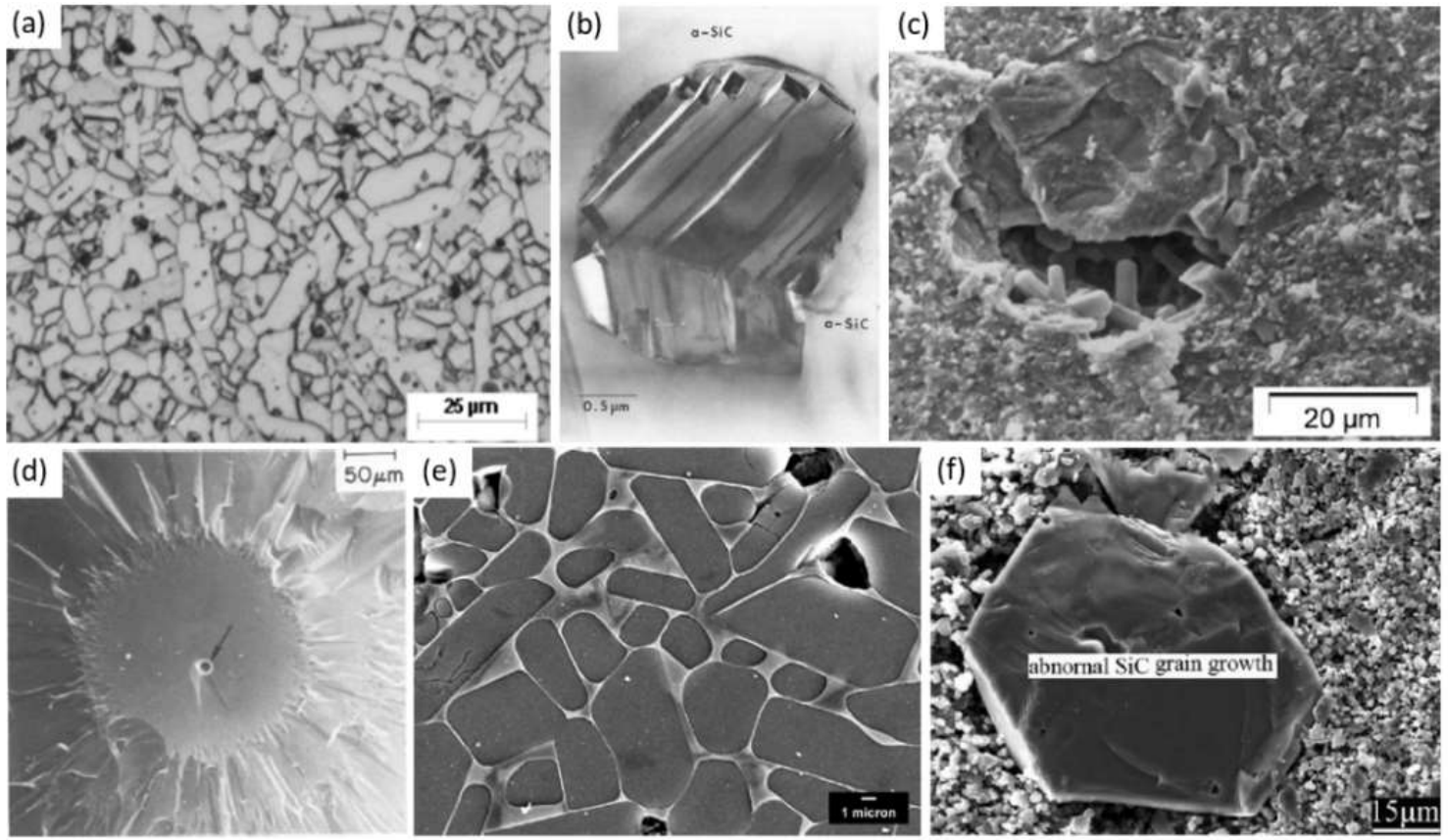


Defect elimination in solids



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Defects to be combated to achieve strength and reliability



Dargaud, PhD thesis (2021)

Eliminate or minimize pores, void, cracks….and do so without excessive temperature

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High end applications in Focus

Ceramic bearings and seals

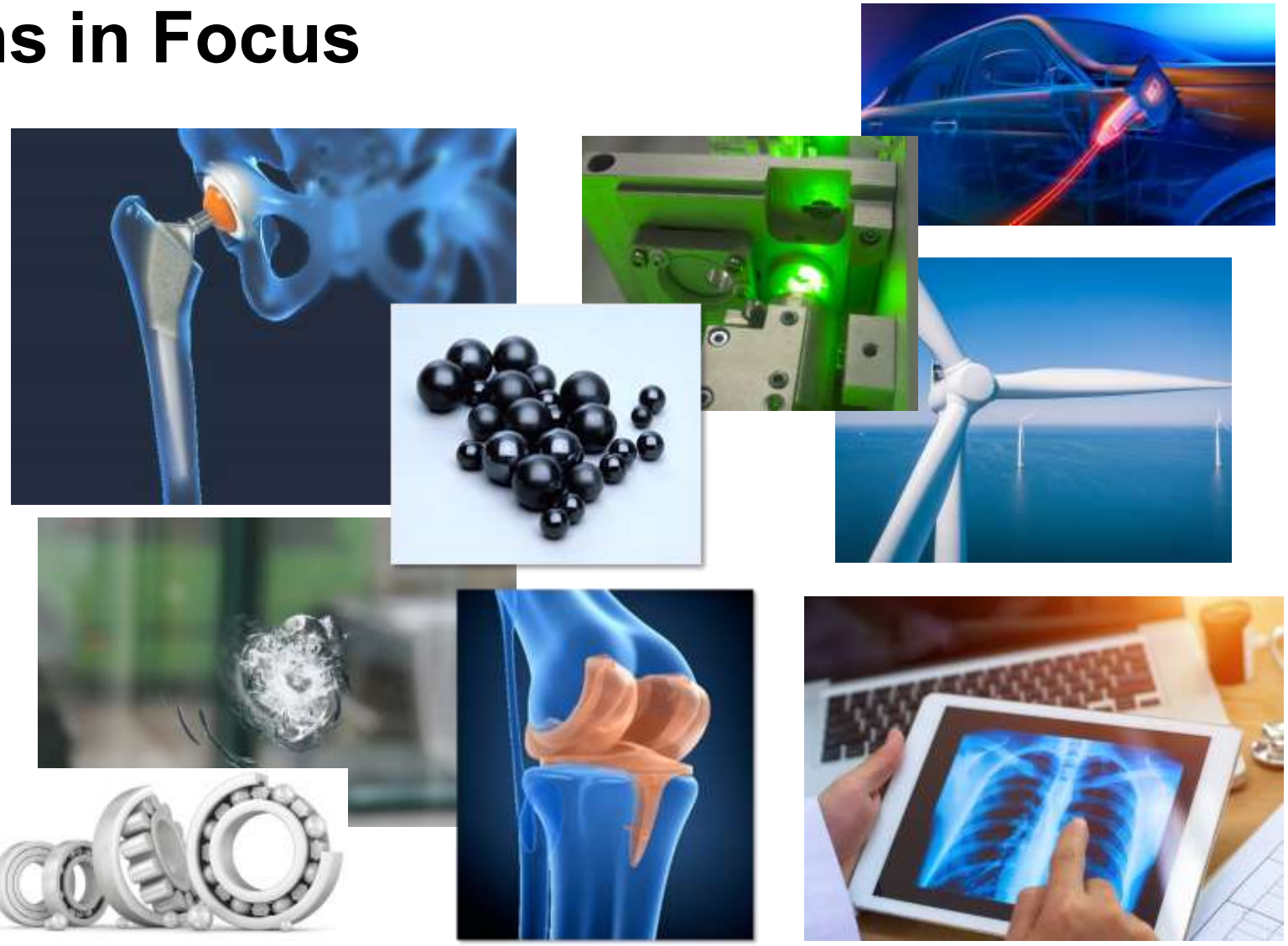
- Silicon Nitride, SiC
- Low density, low inertia
- No electrical and low chemical corrosion
- Tolerant for lubricant starvation
- Crush hard contaminants

Medical implants

- ZTA, ATZ, SN, PSZ, Alumina
- Superior wear resistance
- Best biocompatibility
- Lowest chemical degradation and loss of particles

Optical applications

- Mg-Spinel, AlON, YAG
- High hardness, toughness, low density
- Transparent, translucent
- Possible to dope for scintillation



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