Laser Direct Imaging Material and Process Developments for Next Generation Integrated Chipless RFID

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The focus of LDI MAGIC is the development and fabrication design of innovative LTCC-based mmW RFID-tags which are batteryless and chipless. These can be used for identification and precise localization at the same time, which is not possible in state-of-the-art RFID technology at low cost. The LTCC technology versatility allows the 3D integration of features like dielectric lenses, antenna arrays as well as resonators to store information. For this photo-imageable pastes are necessary, which can be structured using laser direct imaging, for creation of very fine metallized structures down to 20 µm line and space.

Within the project, a new photo-imageable paste was developed and adopted to high frequency suited LTCC (low temperature co-fired ceramics) materials like Vibrantz A6Me, which can be used as substrate material for high frequency applications up to 250 GHz. Using laser direct imaging to process the pastes, incredible high resolutions and edge sharpness can be achieved, which are superior against conventional thick-film processes. Next to this, processes for manufacturing LTCC devices were pushed to its limits and full ceramic GRIN lenses were manufactured.

Both developments enable the manufacturing of the aimed, full-ceramic RFID tags including retrodirective antennas, micro resonators for encoding as well as dielectric lenses, which are durable, long-term stable – which make them the perfect choice for localization and identification in harsh environments using conventional radar front ends.

So, it is possible to provide the next generation of RFID tags using project results to support IoT applications, including warehouses, hospitals, logistic hubs (e.g., seaports, airports), industrial sites, smart cities, and autonomous vehicles using mmW radars that can rely on this approach to localize objects and people with high confidence and perform self-localization with increased reliability.