

Residual stresses in AM parts

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Sirris has acquired a new portable X-ray diffraction stress measurement system within the framework of the FEDER IAWATHA project, subsidised by the European Union and Wallonia. The system is unique in Belgium and provides a very powerful tool to measure the quality of all types of parts - cast, forged, machined, etc. - and processes, such as welding, 3D printing, shot peening or heat treatment. Its ability to characterise local stress is key to improve processing conditions.

The metal 3D printing process involves rapid melting of metal, like the welding process. With 3D printing, stresses build up with each layer as they cool down on top of one other. The dynamic of the stress build-up depends also of the pre-heating of the baseplate and local melting conditions. This complex process of stress build-up may lead to process failure during the build or deformation of the part on the build plate. The stresses are managed using the supports to anchor the part on the build plate until a stress relief is performed and the part removed from the base plate.

Sirris used its system to assess the impact of the stress relief on Ti-6Al-4V control samples manufactured during various jobs. The measurement was done along the build direction. Using this technique it was possible to identify, without any doubt, which samples were heat treated and which samples were in the as-built state. This opens the possibility to assess the material health and stress state, using this tool on real parts and the quality of the heat treatment performed on the

part.

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