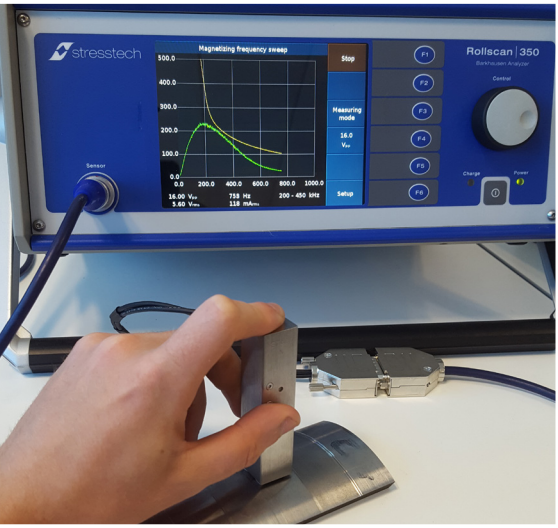
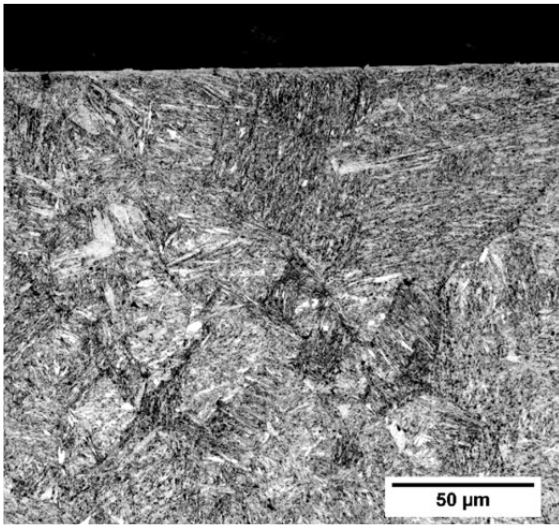
idc Machining Science.

Case Study

Industrial Doctorate Centre in Machining Science





IDC student sponsored by Rolls-Royce and Seco Tools

A non-destructive technique to detect white layer anomalies, which are undesirable on machined components, has been developed for Rolls-Royce by an IDC student at the University of Sheffield Advanced Manufacturing Research Centre (AMRC).

AMRC ADVANCED MANUFACTURING RESEARCH CENTRE / The University Of Sheffield.

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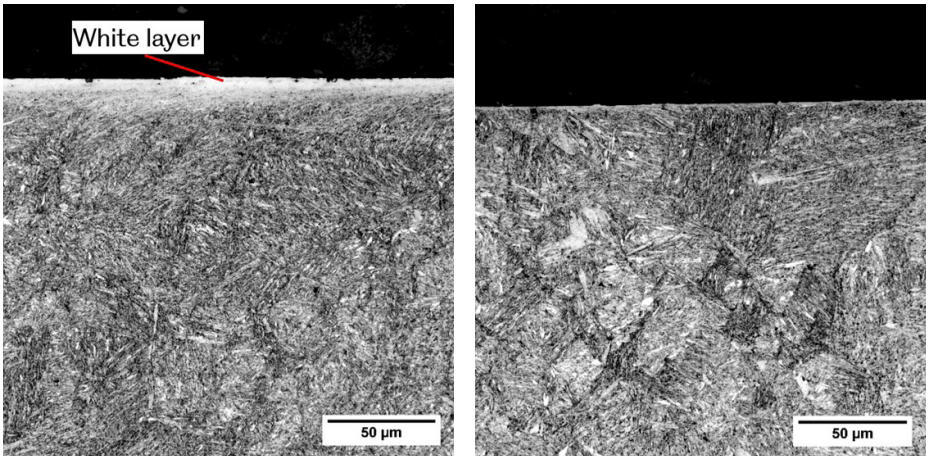

Left: Bad machined surface, created through turning using heavily worn inserts.
Right: Conventional machined surface.

White layers are currently identified destructively, which can be time-consuming and costly due to the many steps involved as samples have to be cut up, in turn destroying it, then grinded, polished and chemically etched before they can be examined under an optical microscope to determine the surface quality.

Third year machining science student Matthew Brown, who carried out the research as part of his EngD sponsored by Rolls-Royce and Seco Tools, wanted to find a fast way to identify machined steel surfaces that would fail destructive inspection and remove the need to test those samples destructively.

To do this, Matthew used a Stresstech Rollscan 350 Barkhausen noise analyser designed for surface quality control and near surface anomalies. Barkhausen noise is a ferromagnetic, non-destructive testing method in which the movement of magnetic domains within a material can be used to obtain information on the microstructure and residual stress state of materials.

Stresstech Rollscan 350 Barkhausen noise analyser.

It is more widely known as a test for grinding burn, where thermal damage

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Matthew Brown

occurs on the surface during the grinding process, but Matthew adapted the commercial system, using it to perform magnetising frequency and voltage sweeps. He then took features from the signals generated by these measurements to separate the samples, allowing him to quickly distinguish machined surfaces with a thick white layer and other samples with a thinner or no white layer.

Matthew said further development is required to be able to test a component whilst it is still in the machining centre, but the initial results meant he was able to determine immediate inspection failures of and those where further inspection was necessary – avoiding the need for unnecessary, costly and time-consuming destructive testing.

"No-one has done this before in the exact way we have on this material," said Matthew. "The ability to detect white layers non-destructively is useful to Rolls-Royce due to the possibilities for automated inspection, which could save time relative to the much longer destructive inspection process."

For more information

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