

ROLLS-ROYCE PLC SEAL FIN

Originally published in: Insight Vol 51 No 5 May 2009

3.2 ROLLS-ROYCE PLC SEAL FIN SAMPLE

Rolls-Royce plc wished to study the effectiveness of novel NDT methods in detecting cracks under conductive coatings and needed a sample with a known crack population. The component chosen for this work was the seal fin region of a turbine disc. In use this component is covered with a wear coating. The task was to create a realistic test piece containing cracks under the coating and by using the Trueflaw method the cracks could be placed in the required position at the tips of the fin. Figure 1. shows a schematic illustration of the seal fin sample.

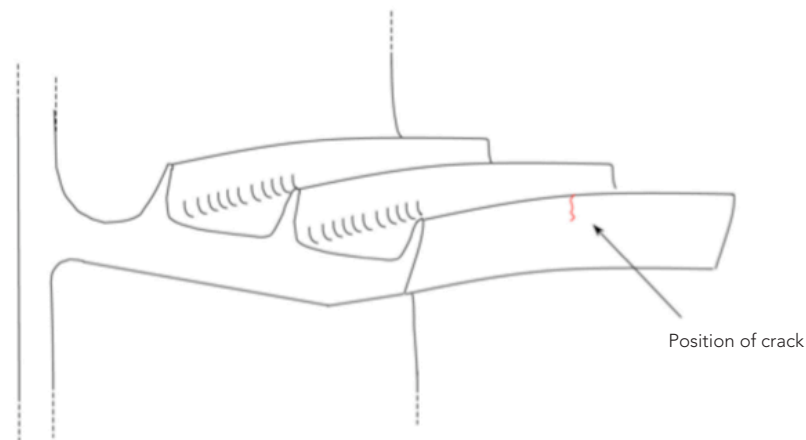


Figure 1
Schematic image of the seal fin sample.

The fin sample was provided by Rolls-Royce plc. The material and geometry were both new to Trueflaw. Consequently, part of the fin sample was dedicated to production test and validation. In this case, all the critical flaw parameters were directly observable and depth validation was not necessary. It was expected, that the crack opening would affect the NDT methods to be studied. Consequently, several production trials were completed to allow production of a variety of crack openings. Furthermore, while doing the production tests it became evident, that different fin locations in the sample had different response to fatigue loading.

Numerous cracks were produced at different locations on the seal fin sample to allow determination of inspection capabilities in all interesting locations. A sample penetrant test (PT) image from a crack produced to the fin sample is shown in Figure 2.

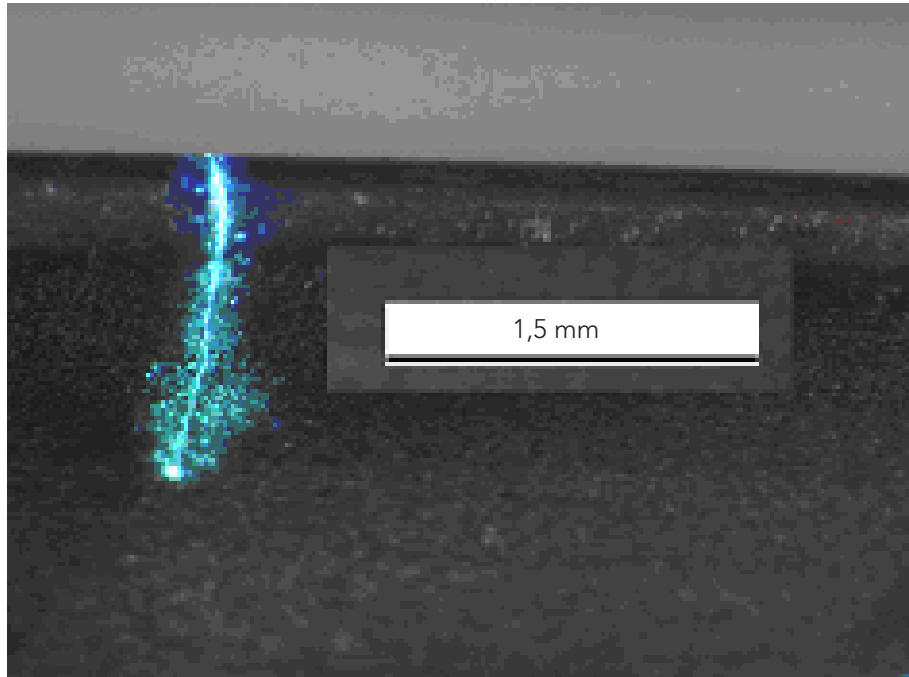


Figure 2
PT indication of seal fin crack.

Characterisation was done by using penetrant testing with magnified digital imaging to measure the crack size and the crack opening. Some uncoated NDT (Thermosonics) was carried out prior to the coating was applied. Following verification of the cracks using fluorescent penetrant the part was coated and a sample crack cut out. X-ray computer tomography was used to visualise the crack under the coating to verify the coating material had not entered the crack. This can be seen in Figure 3a, showing the coated fin. Figure 3b shows the x-ray image with the tip of the fin removed making the crack beneath clearly visible. This sample is now being used in a series of trials to establish if an inspection method is possible.

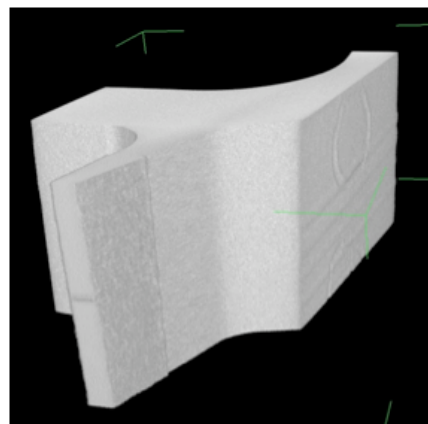
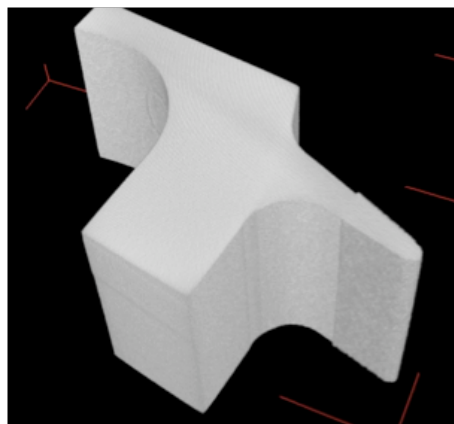


Figure 3a
X-ray image of seal fin showing coating is uncracked.

Figure 3b
Seal fin tip removed from x-ray image showing subsurface crack.