

The Origin of Streaks on Aluminium Alloy Extrusions

X. Zhou, G. E. Thompson, Y. Ma
LATEST2, School of Materials
The University of Manchester

Surface integrity is an important characteristic of high quality aluminium extrusions, especially for applications in the automotive industry. Defects such as streaking (Figure 1) are often present on anodized extrusions of aluminium alloys, increasing the fabrication cost of extrusion profiles. Streaking on the surfaces of anodized extrusions is typically characterised by narrow bands of different contrast to the neighbouring material. The streak bands may appear darker or lighter, duller or brighter, in colour and tone compared to the surrounding material. However, streaking often only becomes visible after etching and anodizing treatments, rather than in the as-extruded condition, making it difficult to identify the original causes of the defect.

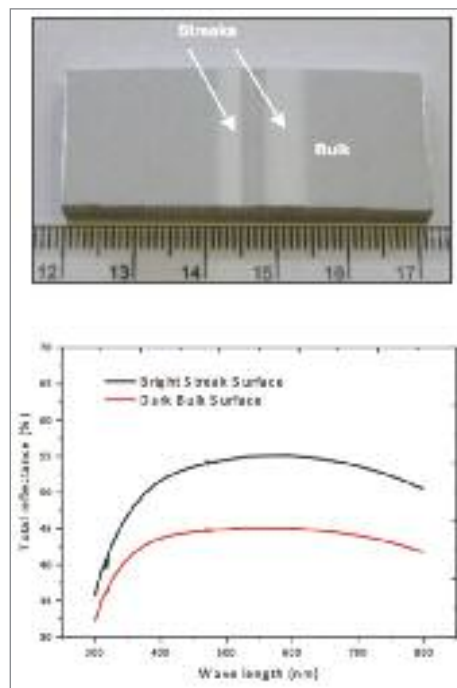
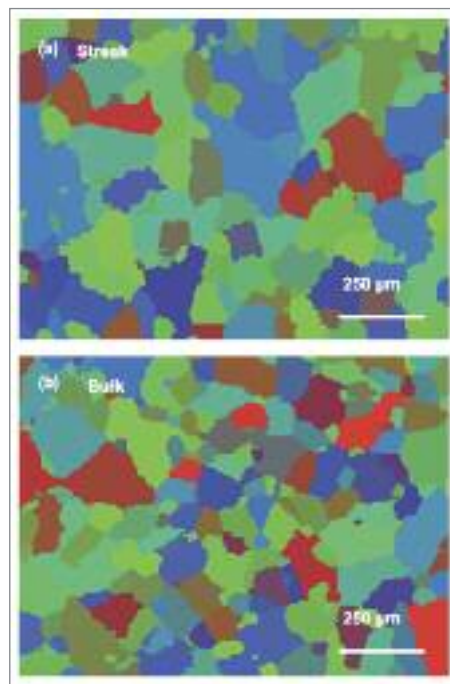


Fig. 1 (a) Optical image of the extrusion with streak defects and (b) total reflectance of the streak and bulk regions.

The objectives of this work are to determine the root causes of streak defects on an anodized aluminium extrusion weld and its associated microstructural features in the alloy and to eliminate the defects. The extrusion was initially etched in sodium hydroxide solution and, subsequently, anodized in sulphuric acid solution. Optical and electron microscopy have been conducted on the as-anodized extrusion and the alloy after film stripping, re-etching and re-anodizing.



It was found that the appearance of etched and anodized aluminium alloy is associated with grain boundary grooves, etching steps and surface scallops, which are determined by the distributions of grain size and crystallographic orientation. It was also revealed that the bright streaking regions are associated with an extrusion weld zone which had relatively large grains with a relatively strong texture (Figure 2). The microstructure resulted in reduced light scattering by grain boundary grooves, surface scallops and etching steps and, consequently, contributed to a brighter appearance (Figure 3). The different microstructure in the streaking regions might have originated from the extrusion process due to non-uniform alloy deformation and non-uniform distribution of friction force, and consequent heat build-up in local regions.

Acknowledgements: This LATEST2 project was performed with support from Sapa Group

Publications: Y. Ma, X. Zhou, G. E. Thompson, J.-O. Nilsson, M. Gustavsson and A. Crispin. The Origin of Streaks on Anodized Aluminium Alloy Extrusions, *Trans. Inst. Met. Fin.*, 91, 11-16, 2013.

Fig. 2 EBSD map of the alloy substrate after film stripping: (a) streak and (b) bulk regions.

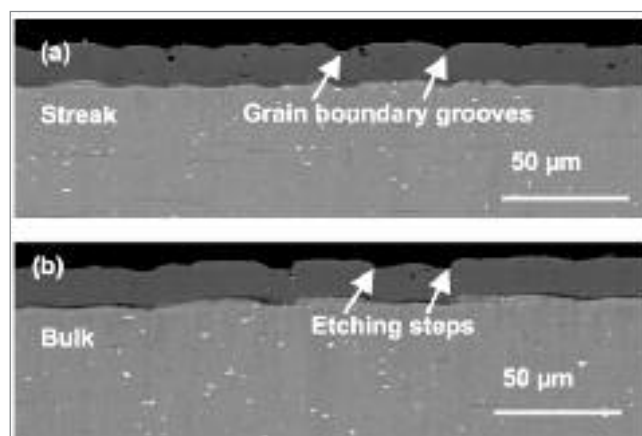


Fig. 3 Backscattered electron micrographs of the cross section of the anodic film attached to the alloy substrate: (a) streak and (b) bulk regions.