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MICROSTRUCTURAL CHARACTERIZATION OF SPRAY FORMED ALLOYS FOR CYLINDER LINERS

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Aluminium silicon alloys with high specific strength, low thermal expansion coefficient and good wear properties, have been extensively used in the automotive, electric and aeronautics industries [1-3]. Among the benefits, it is possible to point out the stability, the performance and the reliance of theses alloys produced by spray forming and used to fabricate cylinder liners for the automotive industry [4].

The aim of present study was to characterise the surface and the microstructure of a cylinder liner, which was produced by spray forming an aluminium hypereutectic alloy. The material was characterised by means of optical microscopy - MO and scanning electron microscopy - SEM.

The surface from an as removed cylinder liner from an engine, showed two distinct regions. One region where the piston rings worn the surface out, see figure 1, and a region not affected by the piston rings, see figure 2. A comparison of both SEM micrographs shows that the worn region undergone some plastic deformation by the friction of the pistons rings. However, it was not noticed silicon particles pull out, which would cause secondary abrasion.

Optical micrographs of the aluminium alloy showed that the silicon particles were even distributed in the aluminium matrix, besides having different size and shapes, see figure 3. This apparent homogeneity may lead to uniform mechanical properties. Figure 4 shows the presence of the silicon particles and as well as a microstructure formation commonly found in eutectic aluminium alloys.

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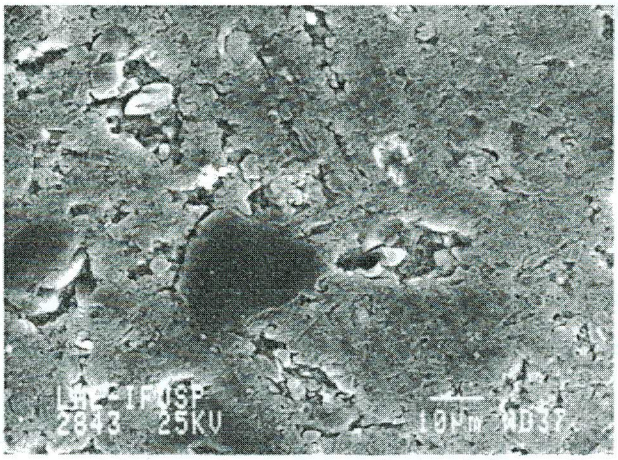

Fig. 1. SEM micrograph of aluminium alloy cylinder liner surface, showing a region worn by the piston rings. It is observed a coarse silicon particle (dark phase) flattened.

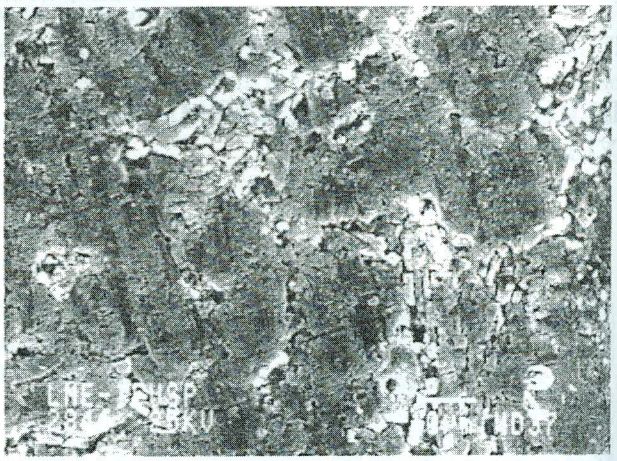

Fig. 2. SEM micrograph of aluminium alloy cylinder liner surface, showing a region not affected by the piston rings. It is observed a homogeneous distribution of particles and surface roughness.

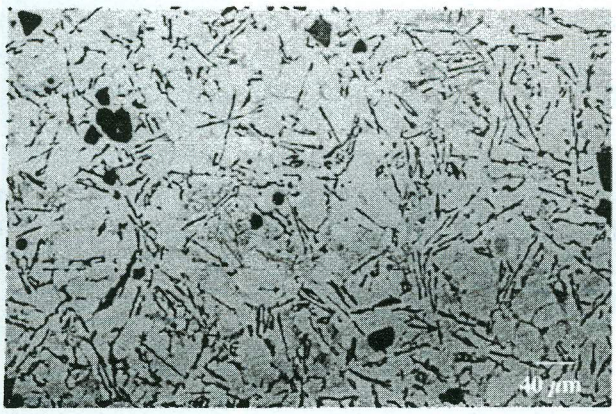

Fig. 3. Optical micrograph of a cylinder liner microstructure, showing primary silicon particles (dark phase) distributed in a eutectic aluminium matrix.

Fig. 4. Higher magnification of fig. 3 showing the eutectic microstructure.