Experiment Brief

Ilion II System and EDAX Velocity and Clarity EBSD Systems

Title

EBSD sample preparation on Al/Mg bulk material using the Ilion II system

Instruments used

Ilion® II system, EDAX Velocity™ and Clarity™ EBSD analysis systems

Background

Sample preparation has always been a prerequisite for successful electron backscatter diffraction (EBSD) testing. Generally, metal samples can be prepared more conventionally, for example, by mechanical grinding and polishing (mechanical polishing), then followed by vibratory polishing. However, it can be difficult to achieve the desired result with this approach for magnesium and aluminum, whose chemical properties make these materials reactive. You can prepare these metals by electropolishing after an initial grinding and mechanical polishing, but it requires selecting the appropriate chemical solution, and the operation is more complicated. In this study, the Ilion II system was used for final sample preparation. With this tool, the process was relatively simple, and EBSD results were easily acquired.

Materials and methods

To begin, the aluminum bulk sample was polished with SiC paper up to 2000 mesh, then with 1 and 0.3 µm alumina slurry for 10 minutes each. Finally, it was processed in a Gatan Ilion II System at 3 kV for 20 minutes and then at 1 kV for 10 minutes. EBSD data was acquired using the Velocity camera at 20 kV, 12 nA beam current, with a working distance of 15 mm and scanning speed of ~1000 indexed points per second (ipps).

The magnesium bulk sample was polished with SiC paper up to 4000 mesh, then with 3 and 1 µm diamond slurry for 20 minutes each. Finally, it was polished in an Ilion II system at 1 kV for 30 minutes and then at 0.5 kV for five minutes. EBSD data was acquired using the Clarity detector at 15 kV, 3 nA beam current, with a working distance of 15 mm and a scanning speed of ~80 ipps.

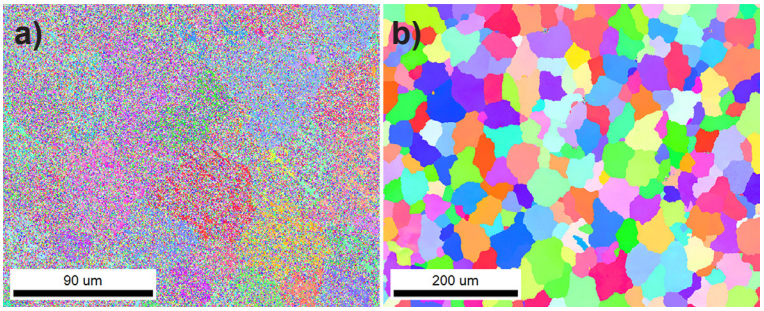

Figure 1. The EBSD inverse pole figure (IPF) orientation maps after a) alumina polishing and b) Ilion II polishing. The indexing success rate (CIS >0.1) is 12.8% and 98.1%, respectively. This shows that the indexing success rate is greatly improved after ion polishing. Results show that ion polishing is a suitable way to prepare an Al sample without vibratory or electropolishing.

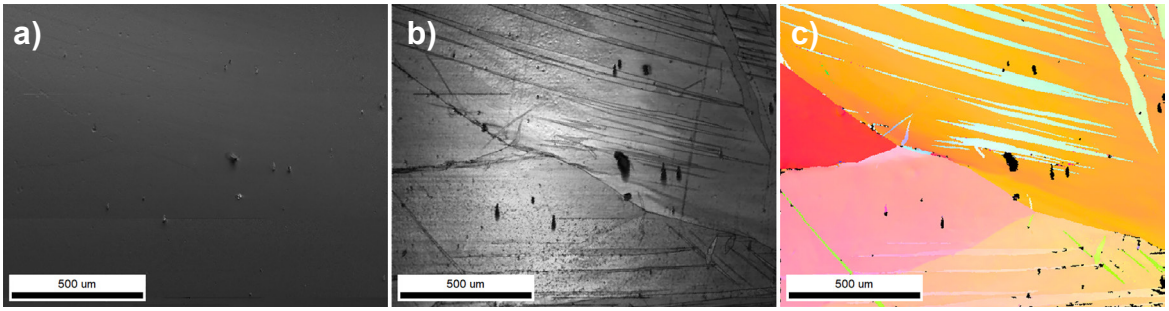

Figure 2. The a) scanning electron microscope, b) Image Quality, and c) IPF map of the magnesium sample after Ilion II ion polishing. The indexing success rate (CIS >0.1) is 99.2%. The sample produced very weak patterns and a low indexing rate before ion polishing.

Summary

The Ilion II was used to prepare aluminum and magnesium bulk samples to achieve better EBSD pattern quality and indexing rates. Ion polishing is an ideal method to prepare these reactive aluminum and magnesium materials for EBSD analysis.

EB-Al-Mg-Bulk-FL2-NJ-MAY23