

Experiment Brief

PECS II Ion Mill and EDAX Hikari Super EBSD System

Title

Damage-free preparation of a porous Zn alloy with a Cu coating

Instruments used

PECS™ II broad beam ion mill and EDAX Hikari Super EBSD system with APEX™ software

Background

Metallic or ceramic coatings are often applied to protect or strengthen an underlying base material. Microstructural analysis of such materials in cross-section by electron backscatter diffraction (EBSD) requires that the contact between the substrate and the coating is planar, and the true structure of both phases is undistorted and continuous to the surface. Specimens with porous substrate materials are especially challenging to prepare because of the increased risk of pulling out grains and retaining coarse polishing particles inside the pores that cause scratches during subsequent polishing steps.

Materials and methods

After routine mechanical polishing, a porous ZnAl alloy with a dual-layer copper plating was mounted in the PECS II and milled using 5 kV Ar ions at an incident angle of 3° for 30 min, followed by 60 min with 4 kV. The long duration was required to remove an oxide layer from the ZnAl matrix material. Some scratches are still visible in the softer Cu coating, but milling was stopped to minimize side-milling of the coating and pores. After milling, the surface of both materials was flat and suitable for EBSD mapping.

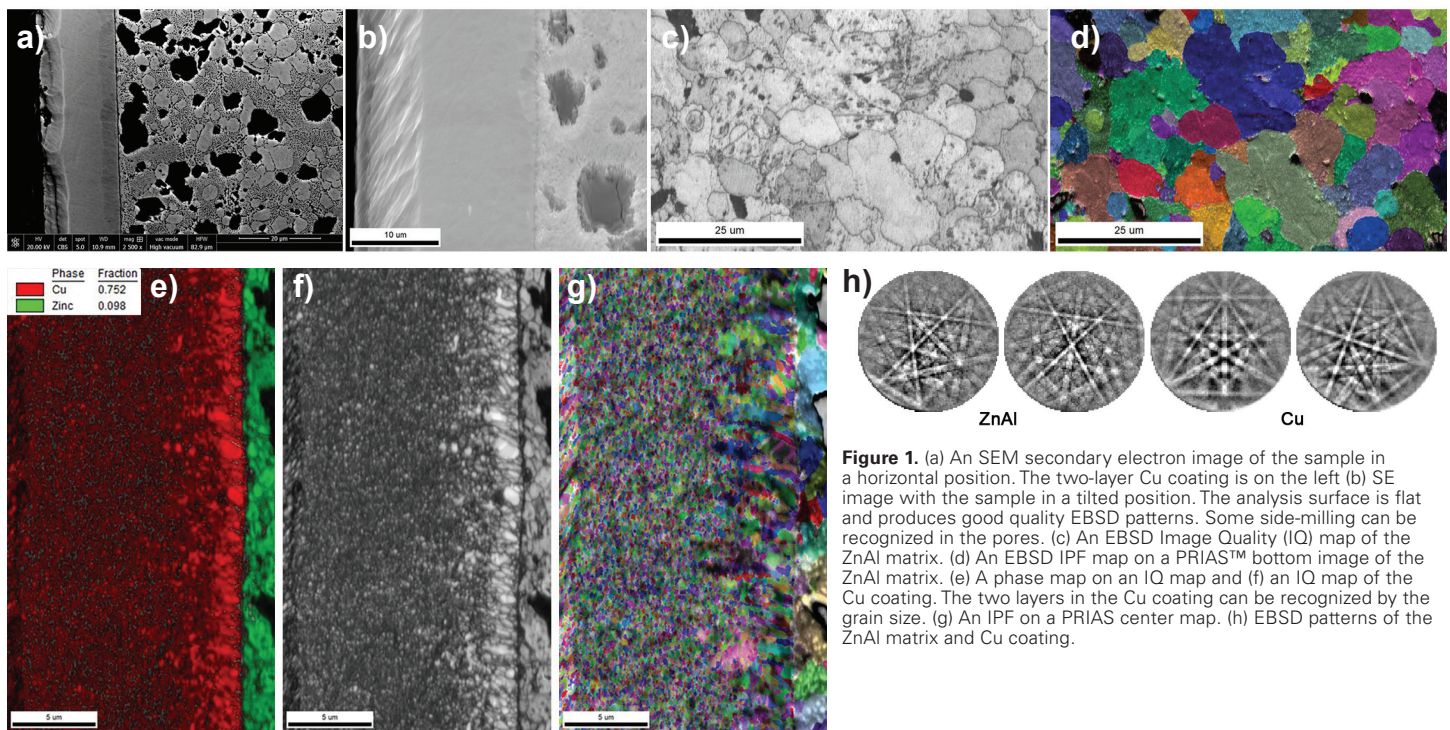


Figure 1. (a) An SEM secondary electron image of the sample in a horizontal position. The two-layer Cu coating is on the left (b) SE image with the sample in a tilted position. The analysis surface is flat and produces good quality EBSD patterns. Some side-milling can be recognized in the pores. (c) An EBSD Image Quality (IQ) map of the ZnAl matrix. (d) An EBSD IPF map on a PRIAS™ bottom image of the ZnAl matrix. (e) A phase map on an IQ map and (f) an IQ map of the Cu coating. The two layers in the Cu coating can be recognized by the grain size. (g) An IPF on a PRIAS center map. (h) EBSD patterns of the ZnAl matrix and Cu coating.

Summary

Materials with a protective or high-strength surface coating can be successfully prepared for EBSD analysis by applying broad beam ion milling. Care needs to be taken to minimize the side-milling effects of free surfaces and pores.