Characterizing Lip Effect on Thin Metal Foils using Model 310 Disc Punch

SBT

Sample Preparation

1.0: Purpose

To determine the amount of deformation caused to a thin brass foil when small 3mm discs are punched out from the sheet stock using the Model 310 Disc Punch. Deformation of the metal foil disc is determined by measuring the thickness prior to and following punching of the discs.

2.0: Procedure

A thin metal sheet of brass stock material with a starting thickness of 0.12" – 0.13" were placed into the Model 310 Disc Punch. Disc punching is traditionally done to thin metal foils prior to sanding down to 100 microns or less thickness, followed by either electrochemical polishing methods or dimpling and ion milling techniques for TEM sample preparation. Deformation of the specimen could possibly lead to dislocation formation or other crystalline defects which can be problematic if defect analysis is to be done to bulk metallic materials.

The Model 310 is a basic disc punch designed for punching out 3mm discs of thin sheet stock. Four different areas of the thin metal foil were measured prior to punching with the Model 310. Following punching, the discs were re-measured to determine the amount of deformation caused. Measurements were taken at four different locations on the punched disc and then averaged to determine the final thickness. Percent deformation was then calculated to determine how much of the total disc area was changed. Below is a chart illustrating the results obtained from the punches.

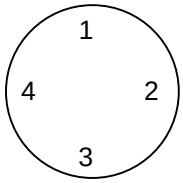

Figure 1: Illustration of the measurement locations used for determining the amount of deformation in a disc punched sample.

Table 1: Deformation Values for Disc Punched Specimens

Initial Thickness (mm)	Final Thickness (mm)	Percent Deformation
0.13	0.1525	17%
0.12	0.1475	22%
0.12	0.145	20%
0.12	0.1425	18%

3.0: Results and Conclusions

It was found that deformation at the foil edges does occur, although not to a significant degree. The "lip effect" is a factor in the limits of the instrument due to the mechanical nature of the punching mechanism. Punches are created by a pin which depresses against the specimen and forces it out from the bulk. This stress at the edges of the punch pin will cause some mechanical deformation. However, work on most metal foils begins with punching and follows with grinding to a final desired thickness of less than 100 microns (0.004").

In the case of brass foils, only about 19% of the edge is deformed, which can easily be removed by further processing, which is standard procedure for preparing thin metal foils for TEM investigation. Therefore the "lip effect" was found to be insignificant.

SBT SOUTH BAY TECHNOLOGY INC.
1120 Via Callejon ■ San Clemente ■ California ■ 92672
Telephone [714] 492-2600 ■ FAX [714] 492-1499 ■ Telex 311882