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Meeting-report

Characterizing Facets on Spherical Particles of $Al_{65}Cu_{25}Fe_{15}$ Alloy by using Scanning Electron Microscope

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In this research, SEM is used to characterize the different facets on spherical particles found in $Al_{65}Cu_{25}Fe_{15}$ alloy, which is prepared by arc melting pure Aluminum, Copper, and Iron. The crystalline structure can be considered as TiNi type cubic crystal system [1, 2]. The SEM used is a Tescan Vega-3.

It has been reported that the facets can be classified into three groups, which are related to 2-, 3-, and 4-fold rotational symmetries of the crystalline structure. These facets share the common feature of possessing flat planes, which is different from the spherical surface of the surrounding. They differ from each other in detailed structures. To have a better understanding in these aspects, these facets are observed from two different perspective, the roughly top-down and the side view. Here, the side view image is defined as SEM image taken when the electron beam is parallel to the plane. We also made the plane parallel to the electron beam scanning direction in the side-view image.

Fig. 1 shows the top-down SEM images of the facets corresponding to 2-, 3-, and 4-fold rotational symmetries and Fig. 2 shows the SEM images corresponding to the side-views of the same facets. The 2-fold facet contains no terrace-like structures while the other two types do. Instead, it is one circular facet that appears to be smaller than the others in terms of its radius. A similar kind of observation can be made between the 3 and 4-fold facets, however, it is less obvious and would need further testing to make any confident conclusions. From the data collected so far, the 4-fold facets appear to have a smaller radius than the 3-fold facets that were examined. This observation can be seen in Fig. 1(b) and (c), and Fig. 2(b) and (c). The diameter of circle corresponding to the 3-fold symmetry is measured to be 5 microns in diameter while that corresponding to 4-fold symmetry is measured to be approximately 4 microns in diameter. To further characterize the facets, the terrace-like structures were examined. In the side view SEM images, the terrace-like structure appears to be parallel lines. It appears that the spacing of these parallel lines for the 3-fold facet is larger than that of the 4-fold facet, implying the rise of the terrace-like structure for the 3-fold facet is larger, as shown in Fig. 2(b) and (c). More detailed examination is required to be certain about these conclusions. It is suggested that these differences originate from their different orientation to the crystalline direction [3].

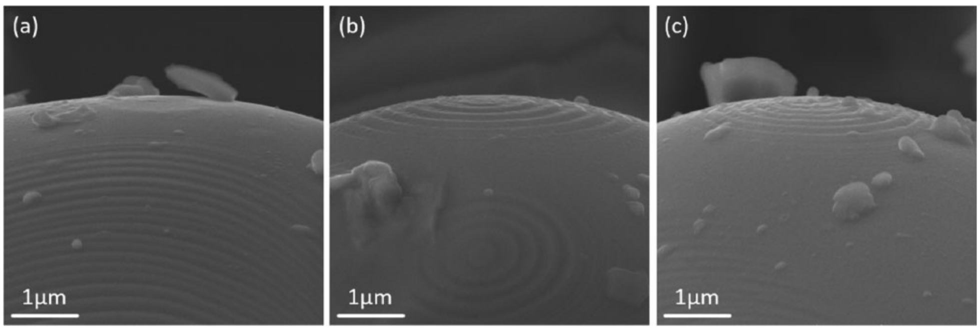

Fig. 1. SEM images corresponding to (a) 2-, (b) 3-, and (c) 4-fold rotational symmetries.

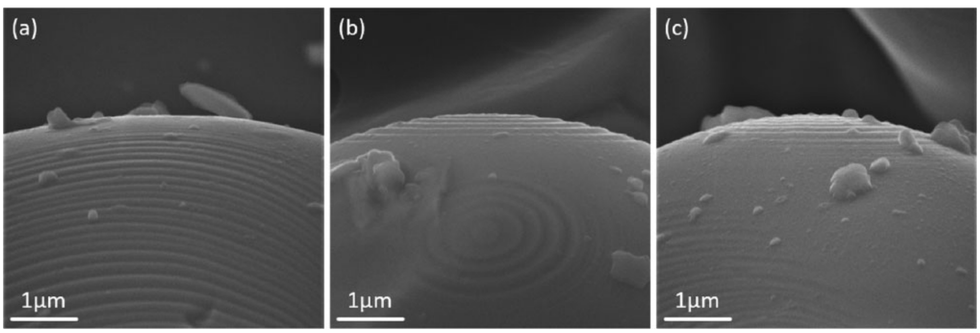

Fig. 2. Side-view SEM images of facets corresponding to (a) 2-, (b) 3-, and (c) 4-fold rotational symmetries.

References

1. C. Li, J. Dobovi, C. Klein, *Material Characterization* **191** (2022) 112158.
2. C. Li, C. Carey, D. Li, M. Caputo, and H. Hampikian, *Material Characterization*, **140** (2018) 162–171.
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