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Energy Dispersive X-ray Spectroscopic Analysis of Al-Cu-Fe Quasicrystalline Thin Film Layer

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The quasicrystalline (QC) thin film in aluminum, copper, and iron (Al-Cu-Fe) alloy is reported. The Al-Cu-Fe alloy is of interest due to its unique properties. Quasicrystals are known to be smooth and the metals used to synthesize the Al-Cu-Fe alloy are relatively cheap [1]. Recently, a QC thin film was discovered on the substrate of a column-like structure of the Al-Cu-Fe alloy's lambda phase, which has not been reported previously [2]. Data collected through our recent studies provided a thickness measurement of the thin film. Our continued work will result in an estimated energy of incident electron beam to analyze the true composition of the thin film with minimum interference from the substrate.

The alloy was prepared by arc melting of pure Al, Cu, and Fe elements. A TESCAN Vega-3 XMU Scanning Electron Microscope (SEM) was used throughout our work. To measure the thickness of the thin film, an imaging software was used and the thickness will be used to determine the composition of the film. Desktop Spectrum Analyzer (DTSA-II) will be used to determine the composition and electron backscatter diffraction (EBSD) to determine the crystalline structure.

An SEM image of the column-like structure on the Al-Cu-Fe alloy is shown in Fig. 1(a). The arrow points to the location of column-like structure. Fig. 1(b) shows the thin film on the column-like structure. Fig. 2 shows Energy Dispersive X-ray Spectroscopy (EDS) spectra taken of the alloy in different locations, on and off of the quasicrystalline thin film. Fig. 3 displays a DTSA-II model of the crystalline structure from the data taken from the EDS in Fig. 2 and was computed using the K (393 nm) and L (382 nm) lines of the spectrum. DTSA-II software is an effective spectrum analysis/simulation tool and will be utilized to analyze the composition of this type of alloy [3]. Varying beam energies will also be used to help understand on the thickness of the sample. With continued study, the composition of the thin film will be determined via the DTSA simulation coupled with experimental EDS spectra.

References:

[1] AI Goldman and M Widom, Annual Review of Physical Chemistry **42** (1991), p. 685.
[2] K Balzuweit et al., Philosophical Magazine B **67** (1993), p. 513.
[3] N Ritchie, J Davis and D Newbury, Microscopy and Microanalysis **14** (2008), p. 1176.

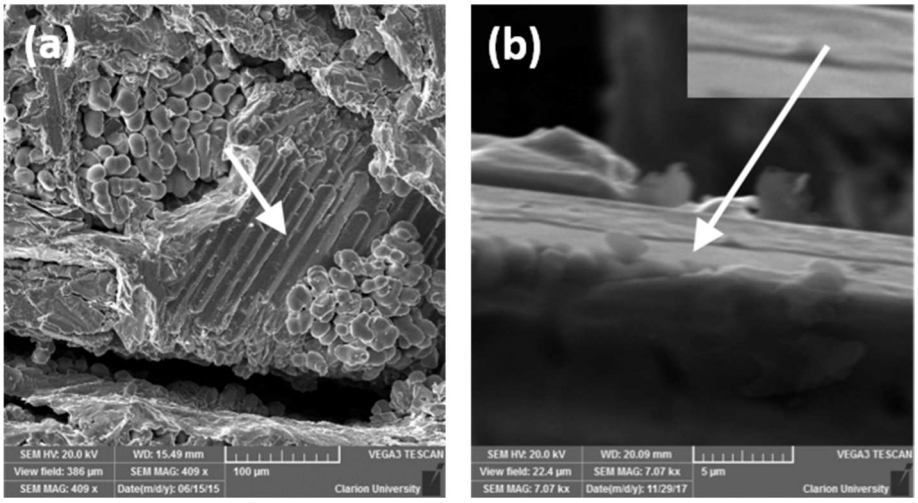

Figure 1. SEM images of column-like structure (a) and the thin film on column (b). The arrow in (a) marks the location of column-like structures and the inlet in (b) shows an enlarged area of the thin film.

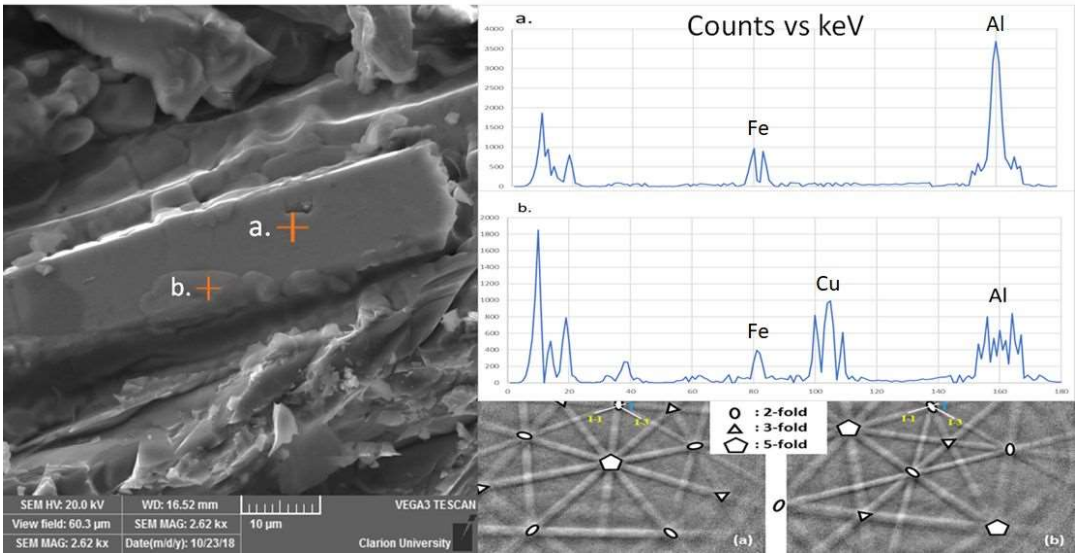

Figure 2. SEM image of the column-like structure where spectra of the Al-Cu-Fe alloy (a) and QC thin film layer (b) were taken.