Atom Probe Study of a Stable Al-Mn-Pd Quasicrystal

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Quasicrystals were first formally reported in 1984 [1], and are currently best described in six dimensional mathematical models. Traditionally they have been studied using Transmission Electron Microscopy (TEM), where certain orientations of the quasicrystal show clear diffraction spot patterns that are forbidden in the Bravais lattices (such as five-fold symmetries in icosahedral systems). To date, there have been no studies of stable quasicrystals using Atom Probe Tomography (APT).

In this study, a stable Al-Pd-Mn quasicrystal [2] was fabricated. The orientation of the grains was initially observed in the SEM using Kikuchi maps (Figure 1), and TEM samples were prepared using focused ion beam (FIB) to best observe the five-fold axis. Once the five-fold orientation was confirmed in the TEM, APT samples in the same region were prepared using FIB. An initial 74-million-atom APT dataset was captured in laser mode using a LEAP 4000X Si (Figure 2), showing the potential of APT to study complex crystallographic structures at the atomic scale.

References:

Figure 2. Atom Probe Tomography reconstruction of a preliminary Al-Pd-Mn quasicrystal.