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Characterization And Properties Of The AlPdMn 5 Surface

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Characterization and properties of the AlPdMn 5 surface

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The surface of the AlPdMn quasicrystal perpendicular to a fivefold axis has been probed by LEED, XPS, Auger spectroscopy, Xray diffraction at grazing incidence and surface EXAFS.
Annealing in ultra high vacuum, after sputtering, at a temperature higher than 700K, reproducibly leads to the formation of a stable surface. This surface exhibits a characteristic and high quality five fold LEED pattern and an estimated chemical composition close to the nominal bulk composition. At the ID32 ESRF beam line, X ray reflectivity has been measured on this surface as the photon energy was scanned through the Mn K absorption edge (ReflEXAFS). Using the bulk Boudard structural model of the AlPdMn quasicrystalline phase, to simulate the observed EXAFS oscillations, we provide further experimental support for a bulk terminated surface. At the irreversible surface transition close to 700K between the sputtered surface (or the partially annealed surface), the Mn 2p core level measured by XPS is changing from a broad asymmetrical peak to a narrow symmetrical peak. This Mn 2p core level peak shape appears as a definite characteristic of the quasicrystalline surface. It correlates with the decreased electron density of states at the Fermi level in the quasicrystalline state. Also during annealing at temperature close to 1000K, Auger spectroscopy shows that the surface aluminum oxide spontaneously disappears. Further annealing in this temperature range reveals a preferential evaporation of manganese and of aluminum in agreement with the relative vapor pressures of Mn, Al and Pd. Associate changes in the surface compositions will be presented.