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Control over Fine Scale Terraces Structures induced on Polycrystalline Pd by Simple Heat Treatments in Air

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Abstract

This paper presents information about the formation of terraces (often composed of relatively wide faces and relatively narrow steps between them) on samples of polycrystalline palladium. These have been formed via simple heat treatments, involving holding at 1200˚C for periods ranging from a few minutes to several hours, followed by quenching by jets of inert gas. These treatments are such that the terraces are created, and survive the cooling, without significant formation of surface oxide. The crystallographic anisotropy of the surface energy is the driving force for terrace formation, with low surface energy planes tending to be preferentially exposed. Information is presented regarding the surface topography of the terraces and of the grain boundary regions, which have mainly been explored using AFM. Typically, the step heights are of the order of 50 nm and the widths of the faces between them are around 1 μm, although there are quite substantial local variations in these figures. It is shown that a degree of control is possible via the grain structure and texture of the sample, as well as via the processing conditions during the terracing treatment~~, although they are determined by a complex interplay of related effects~~.

Keywords: terraces, palladium, surface oxide, surface energy anisotropy, AFM.

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