Title		Hydrogen diffusion in titanium and zirconium hydrides
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Abstract		Full text: Titanium and zirconium form hydrides (deuterides) Ti $H(D)_x$ and Zr $H(D)_x$ with hydrogen (deuterium) concentrations in the range between x = 1.1 (Ti) or 1.5 (Zr) and x = 2.0. In these hydride (deuteride) phases, the metal atoms form a face centered cubic (delta-phase) or face centered tetragonal (epsilon-phase) lattice in which the hydrogen (deuterium) atoms occupy tetrahedral interstitial sites. For the maximum concentration x=2, all the available tetrahedral sites are occupied. The hydrogen (deuterium) atoms in titanium and zirconium hydrides (deuterides) represent, therefore, a model system for a concentrated lattice gas. We studied hydrogen and deuterium diffusion in titanium and zirconium hydride (deuteride) by mechanical spectroscopy (temperatures from 5 to 400 K, vibrating reed technique, frequencies between 160 and 1300 Hz). The experiments yielded large hydrogen (deuterium) induced Zener-relaxation peaks between 240 and 350 K from which the jump rates of the hydrogen and deuterium interstitials were determined with the help of a recent theoretical model for the Zener relaxation in a concentrated lattice gas. The jump rates followed an Arrhenius relation with activation energies of 0.49 +- 0.04 eV (hydrogen in titanium and zirconium), 0.54 +- 0.05 eV (deuterium in zirconium) and 0.60 +- 0.04 eV (deuterium in titanium). Extrapolation of the present hydrogen jump rates to higher temperatures shows surprisingly good agreement with published high-temperature jump rates from nuclear magnetic resonance and neutron spectroscopy, although the jump rates from these techniques were up to eight orders of magnitude higher than the present ones from mechanical spectroscopy. (author)
Descriptor(s)	**DEI**	crystal lattices; deuterides; diffusion; hydrogen; titanium hydrides; zirconium hydrides
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