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Nonstoichiometric molybdenum hydride

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Abstract

The molybdenum-hydrogen system was studied in a diamond anvil cell at high hydrogen pressure up to 30 GPa at room temperature by X-ray diffraction. At pressure around 4 GPa a phase transformation was observed of a bcc metal to a hydride with a hcp metal lattice and H/Mo≈1.1. Further hydrogen pressure increase resulted in a continuous increase of the hydrogen content of the hydride. At about 15 GPa the hydrogen content reached saturation, and no further hydrogen absorption occured up to the maximal reached pressure. The saturation composition H/Mo=1.35(10) was estimated from volumetric considerations.

Keywords:

A. Metal hydrides

B. Gas-solid reactions

C. Crystal structure; phase transitions

D. High-pressure; X-ray diffraction

1. Introduction

The most efficient way to produce hydrides is the use of high hydrogen pressure, which increases dramatically the chemical potential of hydrogen in a gas phase. Recent development of the diamond anvil cell (DAC) technique allowed a series of new transition metal hydrides to be synthesized: $WH_{1.3}$ [1,2], $ReH_{0.85}$ [3], PtH [4], RhH_2 [5], IrH_3 [6], FeH_3 [7] and RuH [8].

At present all transition metals in groups VI-X except osmium were found to form hydrides. Most of them form monohydrides with composition H/Me close to 1, when hydrogen atoms occupy all available octahedral interstitial positions in a close packed metal