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^{57}Fe Mössbauer Study of Nickel Hydride under High Pressure*

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Nickel hydride was studied by Mössbauer measurements with the 14.4 keV resonance in ^{57}Fe at temperatures between 4.2 K and 450 K and hydrogen-to-metal ratios near unity in absorber experiments with 0.15 and 1.0 at.% ^{57}Fe in NiH_x, and in source experiments with ^{57}Co in NiH_x. To avoid hydrogen losses during measurements at temperatures above 200 K, the hydride was subjected to a pressure of about 2.5 GPa. A comparison of the Mössbauer spectra of the source and the absorber experiments reveals differences in the local hydrogen distribution around Fe and Co impurities in NiH_x.

1. Introduction

Previous Mössbauer studies with ^{57}Fe as a dilute impurity in NiH_x [1, 2] have revealed close parallels to similar experiments with ^{57}Fe in PdH_x [3, 4]. Substitutional iron in both β-PdH_x and β-NiH_x was found to interact repulsively with the hydrogen interstitials. For β-PdH_x the dependence of the isomer shift of the ^{57}Fe Mössbauer resonance on the hydrogen-to-metal ratio x ($0.6 \lesssim x \lesssim 1.0$) has been used to estimate the magnitude of the repulsive iron-hydrogen interaction [4]. In NiH_x a similar approach met with difficulties since the samples studied so far [1, 2] all had hydrogen-to-metal ratios close to unity and the isomer shifts showed no clear dependence on x. In the present work we present data obtained in an effort to make samples of NiH_x with x covering as wide a range as possible.

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