Effect of hydrogen on mechanical behavior of Cr-Ni and Cr-Mn-N Austenitic Stainless Steels, and a High Entropy Alloy

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Abstract

In the hydrogen economy infrastructure materials are required for storage and transportation of hydrogen gas. However, hydrogen is known to alter the mechanical properties of materials. Austenitic stainless steels are generally used for components of high pressure equipment. In this study mechanical behavior of Cr-Ni and Cr-Mn-N austenitic stainless steels containing hydrogen was compared. The Cr-Mn-N steels were: 18Cr10Mn-0.3C0.3N, 18Cr10Mn-0.6N, and 18Cr10Mn-0.4N and the Cr-Ni steels were commercially available 304 and 316 grades. Thermal charging of hydrogen was carried out at 300°C and 15MPa. Hydrogen content, tensile properties and microstructure of the steels were characterized. Hydrogen degraded the ductility of all the steels. The loss in ductility will be discussed in view of the stacking fault energy, hydrogen content and martensite fraction of the steels. High entropy alloys are a promising new class of alloys that have caught the interest of the metallurgists. The performance of the well-studied Cantor alloy: Co20Cr20Fe20Mn20Ni20 at.%, was compared with the austenitic steels under the same hydrogen charging conditions.

About The Speaker

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After graduating from the Govt. Engg. College at Pune he worked in the automobile industry before taking up higher education at the Indian Institute of Science. At IISc he qualified the Masters in Engineering, Ph. D and did post-doctoral work. During this time he has worked on non-equilibrium processing, thermomechanical processing, process modelling and empirical modeling. After leaving IISc he worked at GE-Global Research Center and Boeing Research and Technology in Bangalore and at Korea Institute of Science Technology. In KIST he worked variously on hypereutectoid steels, oxide dispersed stainless steels, ferritic stainless steels and precipitation strengthened steels. In the recent past he has worked on the effect of solutes on mechanical behavior of steels and vanadium. At Seoul National University he is responsible for projects on spark plasma sintering of tungsten, alumina forming austenitic steels and high entropy alloy.

In the seminar he will talk on the effect of hydrogen on the mechanical behavior of stainless steels, and high entropy alloy.