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Diffusion parameters of hydrogen in low activation steels

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Diffusion parameters of hydrogen in lowactivation structural steels of austenitic (12Cr-20Mn-W) and ferrito-martensitic (0.1C-9Cr-W-V-Ta) type, designed in Institute of metallurgy and materials sciences of the Russian Academy of Science, together with NIIAR, CNIITMASH and the Dnepropetrovsk pipe institute are studied.

Effect of alloying elements on diffusion parameters of hydrogen in austenitic 12Cr-20Mn-W steel is studied. It is shown, that doping of tungsten, scandium, as well as increase of the carbon content to 2% (mass fraction) decrease hydrogen permeability up to 5 times in a 673－1073 K temperatures range. The maximal decrease of a diffusion coefficient and a hydrogen solubility is observed under alloying by a tungsten and the carbon content 0.2%. The dissolved hydrogen stimulates process of iron α-phase formation in austenitic steel. Influence of temperature and hydrogen treatment on diffusion parameters of hydrogen in 0.1C-9Cr-W-V-Ta is estimated.

The long thermal annealing of normalized ferrito-martensitic steel in vacuum (873 K, 600 h) increases hydrogen permeability and its solubility in 673－1000 K temperatures range. The permeability of hydrogen through weld is measured for 0.1C-9Cr-W-V-Ta steel and permeability of tritium through low activation steel weld is estimated also. It is shown, that in 673－900 K temperatures range permeability of tritium through austenitic steels is almost on the order lower, than for the ferrito-martensitic steel.

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