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THE EFFECT OF CARBIDES ON THE INTERACTION OF HYDROGEN WITH Fe-Ti-C ALLOYS

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Hydrogen is an attractive energy source in terms of availability, environmental friendliness and energy efficiency. The development of hydrogen energy is limited by the problems of hydrogen storage. One of ways to solve this problem is the storage of

hydrogen in solid compounds. Ti-Fe is one of these alloys. Ti-Fe alloys are able to absorb and desorb hydrogen under favorable conditions, and they are capable of reversibly absorbing hydrogen up to 1.9 wt. %.

It was established that carbides, in addition to the strengthening effect, are also useful in terms of hydrogen trapping ability. Since diffusible hydrogen may be sufficient to cause failure, well-designed hydrogen trapping sites may be an appropriate strategy to increase resistance to hydrogen embrittlement (HE). Pure iron has the high sensitivity to HE, which is explained by its high diffusion of hydrogen. When studying steels, both carbides and other microstructural features, such as grain boundaries, dislocations, vacancies, etc., can absorb hydrogen in the reversible or irreversible way. The hydrogen trapping behavior of TiC changed according to its coherent or incoherent interfacial character. The semi-coherent interfaces of the TiC precipitate did not trap hydrogen during annealing, but trapped hydrogen during cathodic charging at ambient temperature, for which the desorption activation energy (Ea) is 55.8 kJ/mol. Incoherent TiC was unable to internally trap hydrogen during cathodic charging at ambient temperature, but absorbed hydrogen during thermal treatment. Ea is 116 kJ/mol for coarse incoherent TiC particles in 0.42C-0.30Ti steel annealed at 700 ºC, which decreased to 68 kJ/mol when the material was annealed at 500 ºC. For coherent TiC in steel Ea is from 46 to 59 kJ/mol depending on annealing.

Therefore, it is assumed that the carbides are effective as hydrogen scavengers and contribute to increased resistance to hydrogen-induced property degradation.

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SOLUTION OF THE PROBLEM OF STATIONARY HEAT CONDUCTION FOR A LAYERED PLATE

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Elements of engineering structures are operated in conditions of a wide range of temperature changes [1, 2]. This leads to the need to take into account the influence of the temperature field when calculating their stress-strain state, but first it is necessary to