On ways of solving the actual problem of compatibility of steels with hydrogen and natural gas

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It has been considered the effective and economical ways [1−5] of solution of some actual technological problems on the basis of development of the necessary (claimed by the technology) basic aspects (fundamentals), revealing the micromechanisms (physics) and interrelation of the processes of aging and hydrogen embrittlement of metallic materials (steels) of the hydrogen energy and cross-country gas pipelines, and the processes′ role in the degradation of the operational properties (including the stress corrosion damages) and the service life of these materials and constructions. A special attention is given to the technological compatibility of metallic materials with hydrogen and the natural gas, and also to the problems of aging and hydrogen embrittlement of steels of the cross-country gas pipelines. It is considered the effective ways of the necessary broadening of the knowledge on the basis of using the new (unconventional) conception-methodology and nanotechnology approaches and methods of systemization and analysis of the existing empiric information, and also the original results of studies of some basic aspects of micromechanisms and interrelation of the processes of aging and hydrogenation of metals [1−5]. Particularly, it is considered a concomitant process of formation of the carbohydride-like (and others) nanosegregation structures at dislocations (with the segregation capacity higher by 1.5−2 orders, than in the Cottrell model) and at grain boundaries, and their influence on aging, hydrogen embrittlement, stress corrosion and physical-mechanical properties of metallic materials, including the service life of steels of the cross-country gas pipelines [1, 2].

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