Hydrogen affecting defect density and mobility in metals and vice versa.

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Defects like vacancies, dislocations and grain boundaries are discontinuities of the crystal lattice and may attract dissolved hydrogen atoms leading to a distribution of site energies and a higher solubility of hydrogen at a given partial pressure of hydrogen gas. On the other hand hydrogen atoms at discontinuities may either enhance or retard defect motion. Hydrogen also affects the generation of defects reducing their formation energies to zero or even negative values, which is the main reason for hydrogen embrittlement of metals or more generally the plastic response of metals under external stress. It will be shown that other solutes as carbon, nitrogen and oxygen act the same as hydrogen on the defect generation. Solute atoms reducing defect formation energies will be called defactants (defect acting agents) in analogy to surfactants (surface acting agents) reducing surface formation energies. The basic physico-chemical laws describing this behavior of hydrogen are presented together with examples of experiments, where these laws are verified or play a major role.