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High-temperature hardness in various steels measured by small ball rebound hardness test

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The temperature dependence of hardness in various steels was measured by using the small ball rebound hardness test, and the effect of carbon state on the high-temperature hardness was discussed. The coefficient of restitution, which is the ratios of the velocities of the impact ball before and after the impact, in eutectoid and hypereutectoid steels was significantly higher than that in ultra-low carbon (ULC) and interstitial free (IF) steels, indicating the high hardness of eutectoid and hypereutectoid steels. IF steel exhibited a general temperature dependence of hardness; the coefficient of restitution decreased continuously with a rising temperature. While ULC, eutectoid, and hypereutectoid steels exhibited the characteristic hardening above 700 K independent of these microstructures and hardnesses. In-situ neutron diffraction measurement during heating revealed that the lattice constant in the ULC steel becomes significantly higher than that in IF steel above 700 K, indicating the solution of carbon. Therefore, it can be concluded that the characteristic hardening above 700 K in ULC, eutectoid and hypereutectoid steels was attributed to the solution of carbon.

Keywords: high-temperature hardness; steel; small ball rebound hardness test; In-situ neutron diffraction; carbon state.

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