Hard Surface Layers by Pack Boriding and Gaseous Thermo-Reactive Deposition and Diffusion Treatments - DTU Orbit (29/09/2019)

Thermo-reactive deposition and diffusion (TRD) and boriding are thermochemical processes that result in very high surface hardness by conversion of the surface into carbides/nitrides and borides, respectively. These treatments offer significant advantages in terms of hardness, adhesion, tribo-oxidation, and high wear resistance compared to other conventional surface hardening treatments. In this work, 4 different materials, ARMCO, AISI 409, Uddeholm ARNE® (AISI O1 equivalent), and VANADIS® 6 PM steel representing different classes of alloys, i.e., pure iron, stainless steel, and tool steels, were subjected to TRD (chromizing and titanizing) and boriding treatments. For the steels with low carbon content, chromizing results in surface alloying with chromium, i.e., formation of a (soft) “stainless” surface zone. Steels containing higher levels of carbon form chromium carbide (viz. Cr23C6, Cr7C3) layers with hardnesses up to 1800 HV. Titanizing of ARNE tool steel results in a surface layer consisting of TiC with a hardness of approximately 4000 HV. Duplex treatments, where boriding is combined with subsequent (TRD) titanizing, result in formation of hard TiB2 on top of a thick layer of Fe-based borides. The obtained surface layers were characterized with X-ray diffraction, scanning electron microscopy, reflected light microscopy, and micro-indentation.

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