

Thermochemical Surface Engineering: A Playground for Science and Innovation

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Surface engineering by thermochemical processing is the intentional change of the composition of a material at elevated temperature with the purpose to improve materials performance. As compared to other surface engineering processes thermochemical processing relies on the presence of components from the starting material for the development of the phases at the surface. Perhaps the most well-known and most widely applied example of thermochemical surface engineering is case hardening of steel by carburizing.

In the present presentation current research and innovation activities in our group are used to exemplify the myriad possibilities with thermochemical surface engineering and the interplay of science and innovation. Distinction is made between processing where interstitial elements are dissolved in the metal, and processing where substitutional elements are provided to change the composition. Aspects of thermodynamics, diffusion kinetics, microstructure development, internal stress and improved materials performance are treated. The examples given encompass the following topics:

- Surface hardening of stainless steel by dissolution of nitrogen/carbon
- Thermo-reactive diffusion with chromium, vanadium or titanium for extreme wear resistance
- Surface hardening of titanium alloys with oxygen, nitrogen and carbon; mixed interstitial phases