Contribution ID: **62** Type: **Oral Presentation**

Advances in thermochemical surface engineering and heat treatment of titanium and titanium alloys

Wednesday, 7 September 2022 14:20 (25 minutes)

Titanium is a lightweight highly corrosion resistant material used in industrial applications as diverse as aerospace, biomedical, military and chemical processing. Titanium's excellent biocompatibility makes it one of the materials of choice for implants and medical devices. Furthermore, titanium is widely used in 3D metal printed applications, which is becoming increasingly popular. However, titanium and titanium alloys suffer from poor tribological properties, including poor wear resistance. Hence, targeted improvement of the wear resistance of titanium surfaces could importantly contribute to their applicability.

Thermochemical surface hardening is the classical way to improve the wear performance of materials, most notably steels. For titanium, thermochemical treatment is challenged by the very strong affinity of titanium to light, interstitially dissolvable elements. In addition, the heat treatment condition (and thus microstructure!) of titanium alloys is an important parameter in thermochemical surface treatment as it has a significant influence on the hardening response. Potentially, the bulk microstructure is affected negatively by the thermal impact of the thermochemical surface treatment. Hence, heat treatment and thermochemical surface treatment are highly interlinked.

The present contribution addresses thermochemical surface treatment and heat treatment of titanium and its alloys. It is shown that relatively deep and hard diffusion zones consisting of interstitials in solid solution can be obtained by gaseous methods. Also, hard compound layers based on one or more interstitials can be obtained. Surface modification by thermochemical treatment to obtain robust white surfaces is also possible; here examples relating to dental applications are showcased. Lastly, titanium additively manufactured by laser powder bed fusion is addressed. The role of heat treatment and thermochemical surface treatment as important post-processing treatments is emphasized.

Speaker Country

Denmark

Register for the Tom Bell Young Author Award (TBYAA)?

Primary author: CHRISTIANSEN, Thomas (Technical University of Denmark (DTU), Department of Mechanical Engineering)

Co-authors: VILLA, Matteo (Technical University of Denmark); Dr JELLESEN, Morten (DTU); SOMERS, Marcel (Technical University of Denmark)

Presenter: CHRISTIANSEN, Thomas (Technical University of Denmark (DTU), Department of Mechanical Engineering)

Session Classification: SURFACE ENGINEERING

Track Classification: Thermochemical treatment (carburizing, carbonitriding, nitrocarburizing, nitriding)