

Science and Engineering Research Program

Project Description

Institute: Collaborative Research Center CRC 1368 "Oxygen-free Production"

Project title: Oxygen-free Production

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The objective of the [Collaborative Research Centre 1368](#) is to develop a basic understanding of the processes and mechanisms involved in manufacturing, assembly, and handling technology in oxygen-free environments. This will open the completely new field of "oxygen-free production", which will add new possibilities to established processes, significantly increase the performance of the products manufactured and enable entirely new processes. Production processes in the metalworking industry are still carried out in the presence of oxygen. The resulting permanent oxidation of the metal surfaces mainly acts as a detrimental factor in production. Even in conventional protective gas atmospheres and in technical high vacuum, sufficiently high oxygen concentrations are present that contaminate the surfaces with oxygen. Due to the presence of oxygen, there is an unexploited potential of technical possibilities in metal processing, which affects almost all production processes. In fact, production in an oxygen-free atmosphere offers considerable technical, economic, and resource-relevant advantages and renders completely new processes possible.

Within the Collaborative Research Centre an oxygen-free atmosphere is generated using silane (SiH_4) doped inert gas. By the reaction of the silane with the residual oxygen contained in the inert gas, oxygen partial pressures of less than 10^{-23} bar, and thus, a practically oxygen-free atmosphere can be achieved at ambient pressure. In this context, the resulting processing environment is adequate to an extremely high vacuum. The achievable oxygen partial pressures are many orders of magnitude smaller than in ultra-high vacuums ($< 10^{-15}$ bar). Due to the strongly reducing effect of silane, such atmospheres also offer various possibilities for removing oxide layers from semi-finished products. The consideration of such deoxidation processes is also an essential part of the planned research.

The following subprojects of the CRC offer a research stay (please indicate 2–3 desired projects when applying):

- [A01 – Compound Casting](#)
- [A02 – Additive Manufacturing](#)
- [A03 – Powder Forming Processes](#)
- [A04 - Sintered Coatings for Hot Stamping](#)
- [A05 – Roll Bonding](#)
- [A06 – Laser Beam Brazing](#)
- [B03 – Cutting](#)
- [B04 – Adhesive-based assembly processes](#)
- [B05 – Thermal plasma joining processes](#)
- [C03 – Tool Wear Protection](#)
- [C04 – Cooling concepts for Grinding](#)

Required skills: -

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