SCIENCE & PROJECTS
Running coordinated DFG projects

Universität Bremen

II RESEARCH TRAINING GROUP 1860: MICRO-, MESO- AND MACROPOROUS NONMETALLIC MATERIALS: FUNDAMENTALS AND APPLICATIONS (MIMENIMA)

The 2nd generation of MIMENIMA PhD students and Postdocs started in October 2016

16 young researchers with different cultural and scientific backgrounds such as engineering, biology, chemistry, and material sciences started their projects on tailored novel porous ceramic structures for applications in energy supply, environmental and chemical processing, as well as space technology in October 2016. Therefore, the DFG-funded research training group Micro-, meso- and macroporous nonmetallic Materials: Fundamentals and Applications (MIMENIMA) celebrated a kick-off meeting, which was a farewell meeting for the 1st Generation as well, on October 17th. Students and

Research Training Group 1860: Micro-, meso- and macroporous nonmetallic Materials: Fundamentals and Applications (MIMENIMA)

Funding: 2013 – 2018 (1st funding period)

Speaker: Kurosch Rezwan

Subproject leaders from MAPEX: Marcus Bäumer, Udo Fritsching, Thomas Hochrainer, Stephen Kroll, Lutz Mädler, Kurosch Rezwan, Jörg Thöming.

Website: www.mimenima.uni-bremen.de

postdocs will work together on this challenging topic within an interdisciplinary team of 13 project leaders from three faculties at the University of Bremen (Production Engineering, Biology/Chemistry, Physics/Electrical Engineering) and from the University of Dresden. In addition to this multidisciplinary research programme, MIMENIMA offers an educational programme with tailored scientific lectures, seminars, lab courses, workshops, summer schools, research visits at international cooperation partners, and a mentoring programme for the career development of women (navigare) and an ongoing coaching of the scientific work.

II PRIORITY PROGRAMME 1676: DRY METAL FORMING - SUSTAINABLE PRODUCTION THROUGH DRY PROCESSING IN METAL FORMING

Metal forming is one of the most energy-efficient production technologies, due to the high degree of material utilisation. Currently, lubricants are applied in all groups of metal forming processes to reduce friction between work piece and forming tool, to reduce tool load, and to protect workpieces against corrosion. From economical and ecological points of view, there is a strong demand to avoid lubricants in metal forming processes, which are mostly mineral oil based and bear a significant environmental impact. Dry metal forming is a process where a work piece leaves the forming tool without the necessity of cleaning or drying before subsequent production steps such as coating or joining processes. The absence of a lubricant as an interlayer between work piece and forming tool, however, results in an intense mechanical interaction between work piece surface and forming tool surface. The central contribution of the priority programme is the development of new dry forming processes and the adaption of relevant technologies to contribute to the goal of a lubricant-free press plant. This can e.g. be achieved by a targeted surface modification or by reducing stresses by process technical measures. The priority programme has currently 11 ongoing projects with a total of 25 participating research institutions from all over Germany.

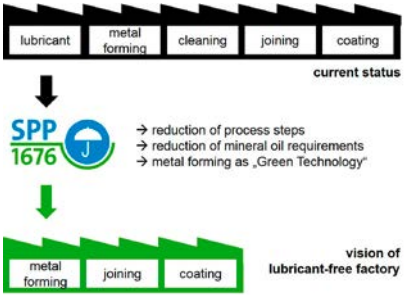
Priority Programme 1676: Dry Metal Forming - Sustainable Production through Dry Processing in Metal Forming

Funding: 2013 – 2019

Speaker: Frank Vollertsen

Subproject leaders from MAPEX: Bernd Kuhfuß, Frank Vollertsen, Hans-Werner Zoch.

Website: www.trockenumformen.de



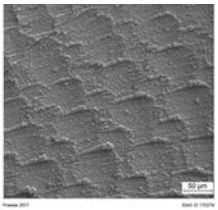


Fig. 1: Vision of the priority programme

Fig. 2: Silicon-based accommodation layer on micro-structured steel substate deposited as prerequisite to enable diamond growth on tool steel.

RESEARCH UNIT 1224: *SCHWARZ-SILBER* ALUMINIUM-CARBON FIBRE REINFORCED PLASTICS (CFRP) TRANSITION JOINTS IN LIGHTWEIGHT CONSTRUCTIONS

Especially for fuel reduction and energy saving, lightweight constructions are very important. Therefore, it is a current topic in the construction of automobiles or airplanes. Because of the high requirements which both industries have to comply with, different materials with different specific properties have been used. The right joining technique is the key for using the whole potential of different materials. For several years, the DFG Research Unit ‚*Schwarz-Silber*' has been investigating joints between aluminium and CFRP with a transition structure. Both materials have a low density, thus they are suitable for hybrid lightweight constructions. In hybrid constructions, conventional joining techniques like bolting, riveting or bonding introduce a weak spot between both materials. In the research unit, several alternative concepts have been developed for joining these two materials. Two of these concepts are the foil concept and the fiber concept. In the foil concept, the open end of titanium sheets, which are integrated in a hybrid laminate with CFRP, will be welded with aluminium. In the fibre concept, glass fibre wovens will be partially cast in aluminium and afterwards carbon fibre wovens will be integrated on the glass fibre wovens via an infusion process. The benefits are light and especially slim joints with no overlaps. Furthermore, these joints have better corrosion properties in comparison to a direct joint of aluminium and CFRP.

On 4th July 2017, overall results of the research unit will be displayed at a closing colloquium which will take place at the Fraunhofer IFAM in Bremen. Interested parties are welcome to attend.

Research Unit 1224: *Schwarz-Silber* Aluminium-Carbon Fibre Reinforced Plastics (CFRP) transition joints in lightweight constructions

Funding: 2010 - 2017

Speaker: Axel S. Herrmann

Subproject leaders from MAPEX: Frank Vollertsen, Matthias Busse, Hans-Werner Zoch.

Website: www.for-schwarzsilber.de

Developments of the Reseach Unit Schwarz-Silber:

Left: Fiber Concept - Right: Foil concept

II RESEARCH UNIT 1845:
ULTRA-PRECISION HIGH PERFORMANCE CUTTING

Ultra-precision milling is an essential process for generating complex optical parts and molds. Due to the required precision, it is typically conducted as a fly-cutting procedure (i.e. only a single cutting edge) at low spindle speed and low feed rate. The consequences are extremely long manufacturing times that can take up to several hours or even days.

The DFG Research Unit ‚Ultra-Precision High Performance Cutting' (UP-HPC) aims to reduce these manufacturing times via scientific means, in order to leverage the economic applicability of this technology in the precision manufacturing industry. This is done in five interdisciplinary subprojects at the Universities of Bremen and Hannover. Collaborating research institutes in Bremen are the LFM (Prof. Brinksmeier) and the bime (Prof. Kuhfuß) and in Hannover the IFW (Prof. Denkena).

The long primary processing times are covered by the Research Unit in three projects, dealing with the development of adjustable tool holders that allow for multi cutting edges to be applied, the exploration of high cutting speed in diamond machining as well as the development of a highly dynamic feed axis on the basis of electromagnetic actuators. For speeding up auxiliary processing times, e.g. tool alignment, (semi)automated balancing procedures are being developed in a fourth project, while the fifth project covers the improvement of process stability at high speeds by using model-based approaches for the machine's control system.

Research Unit 1845:
Ultra-Precision High Performance Cutting

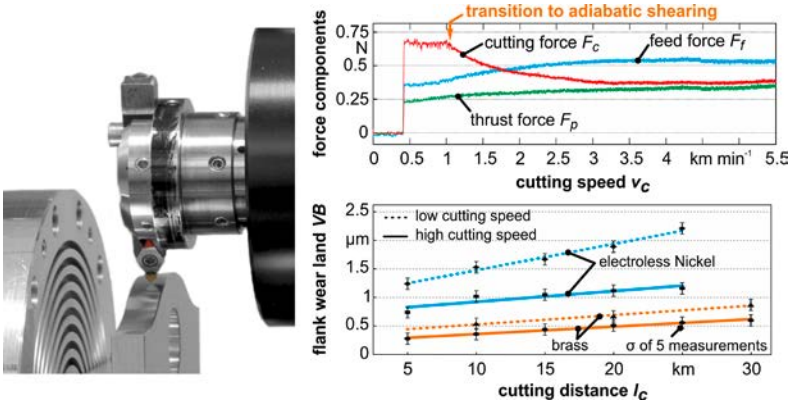
Funding: 2014 - 2020

Speaker: Ekkard Brinksmeier

Administration: Lars Schönemann

Subproject Leaders from MAPEX:
Ekkard Brinksmeier, Bernd Kuhfuß

Website: www.up-hpc.de



Left: ultra-precision fly-cutting of a freeform optic; Right: development of cutting forces and tool wear at high cutting speeds.