**Thesis Project Offer**

*Joint Research and Education Programme “Palestinian-German Science Bridge PGSB” Forschungszentrum Jülich GmbH & Palestine Academy for Science and Technology*

### Thesis type*

- [ ] BSc  
- [x] MSc  
- [ ] PhD  

**Intended starting date (approx.):**

### Contact details of supervisor/responsible host at Forschungszentrum Jülich

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<tr>
<td>Mr.</td>
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**Function**  
Director

**Institute and homepage of institute**

Central Institute of Engineering, Electronics and Analytics – Engineering and Technology (ZEA-1)  
http://www.fz-juelich.de/zea/zea-1/EN

### University affiliation in Germany*

RWTH Aachen, Faculty for Mechanical Engineering

### Co-Supervisor at Palestinian university (if applicable)

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### Project description*

**Investigation of the cold gas dynamic method (CGDM) for coating complex parts with metals**

The Central Institute of Engineering, Electronics and Analytics – Engineering and Technology (ZEA-1) is a scientific technical institute of the Forschungszentrum Jülich GmbH. Mission of ZEA-1 is the design, the development, and the fabrication of scientific and technical equipment, instruments, and processes that are essential for excellent science but are not commercially available.

The core competencies of ZEA-1 are technology development and mechanical engineering of equipment, spectrometers and other components for research using neutron, photon, and hadron beams, for energy and environment research, for soil and plant investigations and for the neuroscience. ZEA-1 has broad and longtime experiences in innovative manufacturing techniques, joining technologies, measurement technologies, automation, and calculation and numerical simulation methods.

In the framework of the “Palestinian-German Science Bridge” education program we offer a fellowship for a master thesis about the investigation of the cold gas dynamic method (CGDM)
The cold gas dynamic method (CGDM) offers new possibilities to join, coat or repair complex parts with different powders and without strong heat treatment. There are two different methods of this technique, low and high pressure cold gas dynamic method. By high pressure method harder and less ductile materials can be applied, but carrier gas (e.g. Nitrogen) at a pressure of about 40 bars is needed to reach the gas velocity of 3 - 4 Mach. By low pressure method compressed air at 6 bars pressure is used, but the exit velocity of the gas stream is only 2 Mach. So there is a lack of energy to deform and join stronger and harder (e.g. steel) particles to the substrate. One possibility to accelerate the particles is to use Helium as carrier gas. At the same pressure of 6 bars velocities up to 3 Mach can be reached.

The influence on the CGDM of different parameters (e.g. powder temperature, gas pressure, powder feeding rate) should be investigated in a Master thesis at ZEA-1. The interaction of different powders (titanium, steel etc.) with different substrates (TZM, CFRP) should be the main focus of the investigation. To measure the velocity and the deformation of the powder particles high speed videography can be used. Further parameters e.g. roughness of the layers, density and shear strength are important properties to be investigated by means of metallography.

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<td>27.10.2017</td>
<td>Prof. Dr. G. Natour</td>
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* required field