



The Royal Academy
of Engineering

Industrial Secondment Scheme Case Study

Optimisation of the drilling process for composite layered materials



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Elaheh Ghassemieh is a lecturer in the Mechanical Engineering department of The University of Sheffield. She has fifteen years of research experience in mechanics of solids, fracture, failure and stress analysis, manufacturing and characterisation of advanced materials with special focus on composites in aerospace, automotive and medical applications using both experimental and simulation techniques. She took her post of Lecturer in Mechanical Engineering at The university of Sheffield in 2003 following her PhD (1999) and Research Associate and then Research Fellow posts at Loughborough University.

The project chosen for her secondment had three parts covering a range of expertise in the mechanical engineering and materials disciplines, including both simulation and experimental aspects.

Why a secondment?

Eli did not have any industrial experience in UK and her overseas industrial experience was some time ago. The main aim of her secondment was to gain familiarity with and experience of the state-of-the-art industrial practice in UK

Seconded to Unimerco Ltd



with a view to increasing the industrial relevance of her teaching. Her industrial secondment was also very timely as she had secured three funded projects from various sources and understanding the research and development (R&D) procedures and expectations of companies prior to the start of these projects was essential for their successful implementation.

Host institution statement:

'Eli's contribution to the development of veined PCD drills was highly valuable. In particular she brought unique expertise in materials and a highly analytical 'scientific' mind set to the challenges of this project. Normally, comparatively small companies such as Unimerco simply can not access this level of expertise. We feel that Eli also benefited from seeing the 'Real World' pressure and constraints of industrial product development.

Unimerco is highly satisfied with Eli's contribution and we sincerely hope that we can work together again in the future on other mutually interesting projects.'

Stuart Dawson
Chief Engineer, Aerospace Development

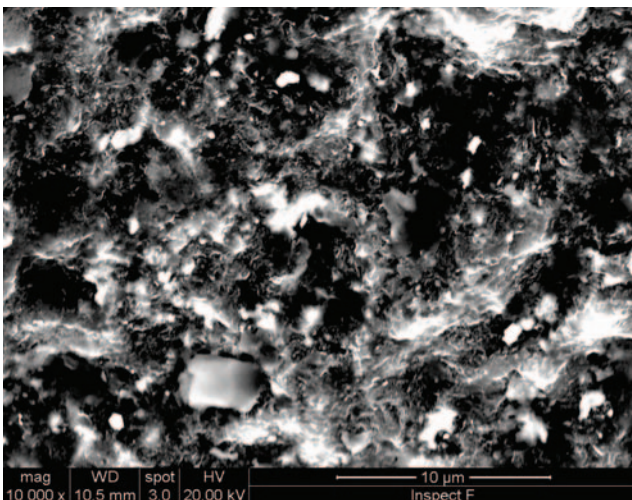
The objectives of the secondment were:

- To gain hands-on industrial experience with a view to strengthening the engineering curriculum through industry-informed teaching.
- To broaden the pool of industrial contacts.
- To identify the most current issues and problems in need of research and development in the cutting tool (and aerospace) industry.
- To create a source for projects and case studies at undergraduate and postgraduate level.
- To enable the Host company to benefit from new, composites and Finite Elements-related techniques and methodologies.

Unimerco Ltd, Fradley

Unimerco Ltd is part of UNIMERCO Group (parent group of UNIMERCO Inc) involved in the design, manufacturing and machining process optimisation of customized carbide and PCD tools.

In UK, Unimerco provides tools to three main sectors, namely Aerospace, Wood and General Engineering, with turnover into the aerospace sector representing 35% of the UK division's total sales. Sales into to the aerospace sector are set to increase even further with Unimerco's involvement in new aircraft programmes including A380, A400M, A350, Typhoon, JSF and the Boeing 787. Over 90% of group aerospace sales come from Unimerco UK and this division is considered to be the Group Centre of Excellence for Aerospace applications. Some of the main customers of Unimerco are Airbus, BAE and Bombardier.



Caption Needed here



Dr Ghassemieh at Unimerco Ltd.

Benefits:

- During her secondment Eli worked on three projects, resulting in a new design tool and an abundance of data for student projects. These included:
 - Finite element (FE) analysis as a new tool for designing tool geometry/tool material suitable for CFC/metal stack drilling.
 - Study of the effect of the machining parameters on the C7 coated carbide drills.
 - Study of the microstructure/property relationship in the PCD structural integrity and tool life.
- The secondment facilitated the identification of areas in need of development and research, some of which have already been fed to PhD projects. Others were used to write proposals to attract funding from research councils.
- The secondment work resulted in a conference paper and other publications are also planned.
- Links were built with other companies including, for example Airbus.
- The failure models developed and the stress analysis of the CFC during the drilling process were used as a case study in the Composites module offered to fourth year students. The wear and chipping of the drill observed during the drilling tests were used as examples of different types of failure taught in the first year Design module. The drilling process parameter limit and its effect on the failure and fatigue of the work piece was used as the assignment for the Advanced laboratory offered to the third year students.

For further information please contact

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The scheme application form and guidance notes for applicants are available to download from The Academy's website:

<http://www.raeng.org.uk/research/univ/secondment/>