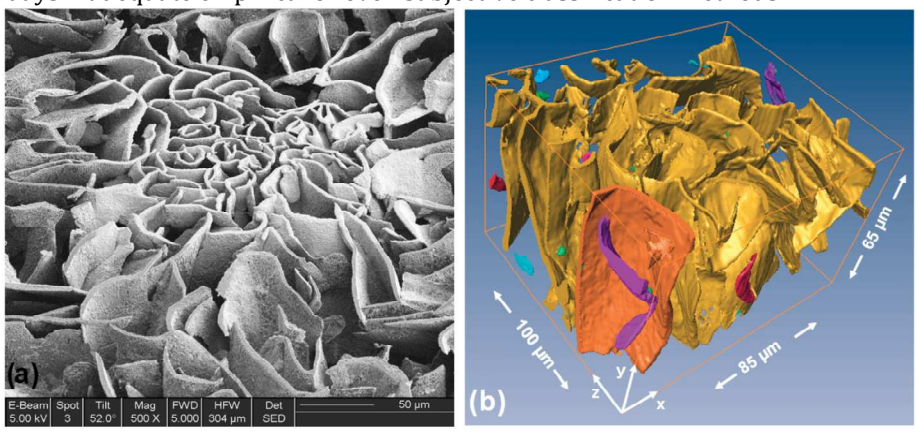
DocMASE Project Proposal 2013-09

Project Title	Advanced 3D Classification of Graphite in Cast Iron
Main University and Advisor	Saarland University (Germany) / Prof. Frank Mücklich
Second University and Advisor	Technical University of Catalonia (Spain) / Dr. Emilio Jiménez Piqué
Project Description (with **image**, if applicable)	Advanced cast iron materials with nodular and lamellar graphite precipitates, whose geometry will be exactly defined, are essential for new generation, off-shore wind-power plants. Moreover, a need exists for the development of thin-walled, lightweight motor blocks for hybrid diesel engines and of graded materials with well-defined transitions between the different graphite particle geometries. The complex and well tailored geometries of these high performance materials must be understood in detail as they control all highly demanding materials properties. Today new emerging tomographic possibilities provide for the very first time all complementary 3D information in different lengthscales. In this project, an advanced classification routine based on 3D tomographic data (FIB/SEM Tomography) will be developed for graphite morphology in cast iron. A data mining tool for classification of 2D images will be directly trained by the highly reliable data from evaluating the virtual sections of tomographically investigated volumes. In this case the 2D classification procedure benefits from no longer being empirical and will also fulfill the industry's strongly growing requirements for reliable materials quality control. This control urgently needs reproducible and fully objective classification strategies to replace the widely used but nowadays inadequate empirical or even subjective classification methods.  [1]
Previous Publications	[1] Velichko, C. Holzapfel, F. Mücklich; „3D Characterization of Graphite Morphologies in Cast Iron"; *Adv. Eng. Mater.* ***2007**, 9, 39.* [2] A. Velichko, C. Holzapfel, A. Siefers, K. Schladitz, F. Mücklich; „Unambiguous Classification of Complex Microstructures by their Three-dimensional Parameters Applied to Graphite in Cast Iron"; *Acta Mat.* ***2008**, 56, 1981* [3] Velichko, F. Mücklich; "Quantitative 3D characterisation of graphite morphology in cast iron - Correlation between processing, microstructure and properties"; *Int. J. of Mater. Res.* ***2009**, 100 [8], 1031* [4] Hatton, M. Engstler, P. Leibenguth, F. Mücklich; "Characterization of Graphite Crystal Structure and Growth Mechanisms Using FIB and 3D Image Analysis"; *Adv. Eng. Mater.* ***2011**, 13, 136*
Requirements of the candidates / Requirements during the doctoral programme (courses, seminars, etc.)	Very good English command. Bachelor in Materials Science, Chemistry, Physics or related disciplines. Master in Materials Science or related disciplines. Previous experience in metallography, quantitative image analysis, 3D image processing and FIB/SEM will be of advantage. 30 ECTS must been acquired during the program according to the minimum requirements of DocMASE.