DocMASE Project Proposal DAAD-2017-2-New

Project Title	**Experimental and numerical investigation of curing process of polymers**
Main University and Advisor	Saarland University, Prof. Dr. Stefan Diebels (Chair of Applied Mechanics)
Associated Partner(s) (if applicable)	
Project Description (with **image**, if applicable)	The project aims on the modelling of the curing process of polymer joints. The project contains an experimental and a theoretical part. In a first step, experiments will be performed to characterize the mechanical properties of a polymer during curing. Based on these data a constitutive model will be developed which describes the evolution of the material properties during the curing process. Two materials will be investigated. One is a thermoplastic polymer. In this case the curing is based on a thermal induced phase transformation from a fluid to a solid. The curing process can be formulated by extensions of visco-elastic models. The second is a duroplastic polymer / elastomer, i.e. a two-component system where the curing is based on a chemical reaction of both components. The basis for phenomenological models are formulated e.g. by Hossain et al. [1] and Liebl et al. [2] In this project a micromechanically based model will be used taking care of the change of the chain distribution and the corresponding chain kinetics. This will lead to a modification of the Arruda-Boyce model [3].
Previous Publications	[1] M. Hossain, G. Possart & P. Steinmann: A small-strain model to simulate the curing of thermosets. Comput. Mech. 43:769-779, 2009 [2] C. Liebl, M. Johlitz, B. Yagimli & A. Lion: Three-dimensional chemo-thermomechanically coupled simulation of curing adhesives including viscoplasticity and chemical shrinkage. Comput. Mech. 49(5):603-615, 2012 [3] E.M. Arruda & M.C. Boyce: A three-dimensional constitutive model for the large stretch behaviour of rubber elastic materials. J. Mech. Phys. Solids 41(2):389-412, 1993.
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. Knowledge of German will be appreciated but not compulsory. The general requirements for the DocMASE program regarding courses, seminars, summer schools, etc. must be fulfilled. Particulraly, 30 ECTS of lectures have to be validated at the end of the PhD and you are expected to publish the results of your studies in international peer-reviewed journals.