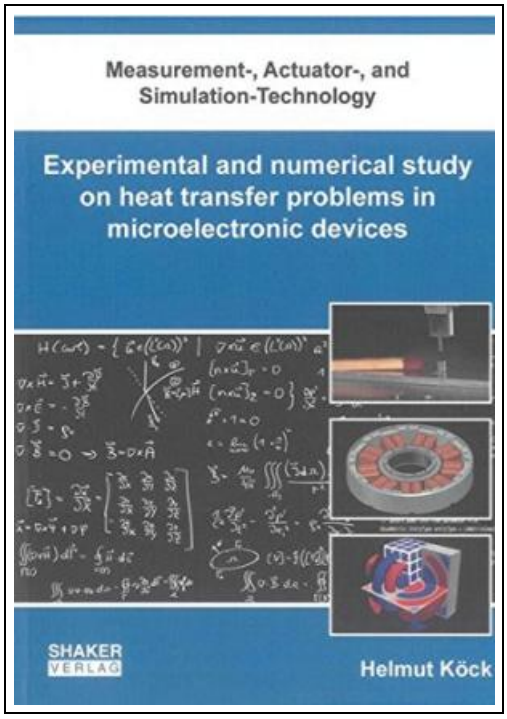
Experimental and numerical study on heat transfer problems in microelectronic devices



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(Miss Fanny Osinski V)

EXPERIMENTAL AND NUMERICAL STUDY ON HEAT TRANSFER PROBLEMS IN MICROELECTRONIC DEVICES

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Shaker Verlag Dez 2013, 2013. Buch. Book Condition: Neu. 214x151x22 mm. Neuware - Today, power semiconductor products are increasingly used to enhance energy efficiency, safety as well as comfort and convenience in automotive and industrial applications. These requirements ask for particularly high robustness and reliability in a market environment where the best technical solutions are challenged by high cost pressure. At the 'Kompetenzzentrum für Automobil- und Industrieelektronik GmbH (KAI)' several groups search for solutions to improve the robustness and reliability of power semiconductor devices. The goal of the engineering group is to study the long term behavior of power devices in the challenging automotive and industrial environment. Supported by proprietary test systems for accelerated testing developed and operated at KAI [77,79], power devices are tested in parallel under extreme electrical and thermal stress conditions. End-of-life data of several of hundreds of devices per month are the basis for statistical analysis. Using these experimental lifetime data, statistical methods (i.e. Bayesian approaches) are applied to evaluate existing data and further provide forecasts in order to reduce test time and costs [22,23]. At the same time, the physical device characterization group as well as the simulation group are acquiring advanced knowledge regarding destruction and degradation (fatigue) effects. A detailed understanding of the underlying degradation mechanism requires extended physical analysis, thermal and mechanical material characterization as well as a validation of physical models with the aid of finite element simulation. What all groups have in common is that temperature is the fundamental stress parameter related to robustness and reliability issues in power semiconductors. Indeed, parameters affecting the process from gradual fatigue towards ultimately destructive events are manifold. Rapid temperature variations during electrical stress events cause substantial fatigue phenomena driven by mechanical stress due to a mismatch in mechanical properties (i.e. thermal expansion coefficient, yield...

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