

# Fusion Plasma, Surface Engineering and Fusion Reactor Technology – Status Quo and Quo Vadis?

**T. A. Scherer<sup>1</sup>**

<sup>1</sup> *Karlsruhe Institute of Technology KIT, IAM-AWP, Karlsruhe, Baden-Württemberg, Germany*

Today, the research on magnetic confined high-temperature plasmas and on inertial fusion plasmas has the ultimate goal of electrical energy production by nuclear fusion devices to solve the energy problems of the mankind. In this talk an overview of the alternative fusion concepts is shown. Three concepts are part of intensive investigations: the Tokamak-, the Stellarator and the inertial fusion concepts. The different approaches in plasma physics are explained due to physics, operations and technology. Important for all concepts is the gain of energy. It is necessary to heat up the plasma to high temperatures to reach the fusion ignition condition. In the second part of the talk the use of surface technology is discussed exemplarily at the most critical safety barrier “High Power Microwave Diamond Window” for Megawatt heating power transmission into the fusion plasma. This technological device is a key component for magnetic confined plasma systems. The production of the diamond disks is a microwave assisted chemical vapor deposition process (MA CVD). Due to hydrogen isotope diffusion processes, new passivation techniques are discussed for a safe operation mode.

The bottleneck of technological realization of a nuclear fusion reactor are the material properties. An overview of state of the art will be presented. In the last part of the talk existing machines (Wendelstein-7X, ITER) and new machines for the future (EU DEMO FPP – FOAK, VNS) are proposed, as well.