## Materials for the plasma-facing components of fusion reactors

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To conceive and develop suitable materials for the plasma-facing components of fusion reactors is a major endeavour on the way towards economic fusion power production. During operation the plasma facing materials have to fulfil very complex and sometimes contradicting requirements which have to be reconciled by materials engineering. These requirements span from plasma compatibility, low erosion and the related long lifetime, controllable tritium inventory, from thermomechanical stability and good heat transfer properties to stability under neutron irradiation and, possibly, to low neutron activation. The plasma-facing materials are bonded to a structural or heat sink material which is low activation steel for the first wall, or to a high thermal conductivity heat sink for the divertor.
At present, tungsten-based materials show the highest promise as plasma-facing material. Experiments in the ASDEX Upgrade tokamak at IPP indicate that plasma operation is feasible with walls and divertor surfaces mostly covered with tungsten. Calculations of the erosion lifetime indicate that continued reactor operation for several years may be possible. Thick tungsten coatings have been deposited by plasma spraying on ferritic/martensitic first wall mock-ups and show good adhesion and stability. The bonding technology to Cu-based heat sink materials is being developed for ITER. Alloying of tungsten with plasma compatible elements may intermit the runaway oxidation under accidental air ingress.
Recent breakthroughs in ceramic thin film barrier technology show that the tritium used in the fusion device can be prevented from migrating into materials structures and from entering the coolant. These barrier films are based on atomically deposited crystalline alumina or erbia.
Alternative divertor heat sink materials with very high thermal conductivity have to operate at temperatures well beyond those accessible with existing copper-based materials. SiC-fibre reinforced copper composites which are presently being developed should allow operation at reactor relevant coolant temperatures.

### Prof. Dr. Dr. Hans-Harald Bolt

After studying mechanical engineering (1980 - 1985) at the Rhine-Westphalia Technical University (RWTH) in Aachen, Hans-Harald Bolt took his PhD in 1988 on the subject „Behaviour of Materials Subjected to Transient Thermal Surface Loading“ at RWTH. Between 1986 and 1988 Bolt did research at the Universities of Osaka and Nagoya, being awarded in 1990 the degree of Doctor of Engineering by the University of Nagoya for his work on „Runaway-Electron Materials Interactions”. He worked at Max-Planck-Institute of Plasma Physics (1988 - 1990) as a postdoc with the NET. From 1990 to 1992 he was Associate Professor at the University of Tokyo. team and from 1992 to 1998 as a research scientist/group leader with the Research Centre Juelich, Germany, at the Institute for Materials in Energy Technology in the field of plasma-material interactions. From 1995 till 1998 he was also Professor at Wuppertal University in the field of plasma technology. Since January 1999 Hans-Harald Bolt has been Scientific Fellow of Max-Planck-Institute of Plasma Physics and Head of the Materials Research Division and Honorary Professor at the Technical University of Munich.