

HIGH TEMPERATURE SUPERCONDUCTOR CURRENT LEADS - PROPOSAL FOR ITER

W. H. Fietz, R. Heller, V. L. Tanna, G. Zahn
Forschungszentrum Karlsruhe, Institut für Technische Physik, Karlsruhe, Germany

R. Wesche
Centre de Recherches en Physique des Plasmas, Villigen, Switzerland

E. Salpietro and A. Vostner
European Fusion Development Agreement, Close Support Unit, Garching, Germany

ITER uses operation currents up to 68 kA that have to be transferred from room temperature (RT) to 4.5 K for the superconducting magnet system by specially designed current leads (CL). The ohmic losses of conventional CL cause high heat loads to the refrigeration system. This load can be reduced drastically by the use of High Temperature Superconductor (HTS) current leads because the superconducting HTS part of this CL causes no ohmic losses.

The Forschungszentrum Karlsruhe and the CRPP Villigen have designed and built a 70 kA current lead using Bi-2223 HTS superconductor in the frame of the European Fusion Technology Programme. This HTS CL was installed and tested in the TOSKA facility of the Forschungszentrum Karlsruhe showing that the current of 68 kA can be carried by the CL even when the highest temperature in the HTS part is 85 K. The option that all ohmic losses in the temperature range between 4.5 K and approx. 80 K can be eliminated using HTS CL is very attractive because massive savings in investment and operation costs are possible by removing this load from the cryogenic system.

The requirements for the HTS current leads will be outlined and the consequences with respect to investment and operation costs will be discussed in detail comparing the ITER design with and without HTS CL.