ADVANCES IN HIGH POWER CALORIMETRIC MATCHED LOADS FOR SHORT PULSES AND CW GYROTRONS (P3-B-316)

William Maurizio Bin, Alessandro Bruschi, Sante Cirant, Franco Gandini, Gustavo Granucci, Vittoria Mellera, Valerio Muzzini, Antonio Nardone, Carlo Sozzi, Nicolo\' Spinicchia

IFP-CNR, Assoc. EURATOM-ENEA-CNR sulla Fusione via Cozzi 53 20125 Milano Italy

The development of high power gyrotrons for plasma physics research needs proper matched and calorimetric loads able to absorb and measure the power, which nowadays is foreseen to be as high as 2 MW during CW operations. To this end IFP/CNR has developed a family of matched loads useful in the mm-wave frequency band for applications ranging from a few ms to CW in pulse length. The different loads in the family, made of an integrating sphere with a partially reflecting coating on the inner wall, are characterized by having the same absorbing geometry for the incoming beam and a different heat removal system for the specific application.

Some important advances have been recently achieved from the point of view of the uniformity of power distribution on the absorbing wall and of the load construction.

With high precision achieved in the coating thickness a better control of the heating power distribution is possible by proper shaping of the local reflectivity, in addition to the shaping of the mirror dispersing the input beam. A more sophisticated model describing the power distribution has been developed, taking into account a variable thickness of the absorbing coating, the proper shape of the spreading mirror, the frequency of the incoming radiation and the shape of the input beam. Lower coating thickness is shown to be preferable, at equal local reflectivity, from the point of view of a lower peak temperature and thermal stress.

The paper describes a load with variable coating thickness along the meridian of the sphere, showing a uniform power deposition on the inner walls.

The cooling pipe is completely electroformed on the spherical copper shell, ensuring the maintenance of the correct curvature of the inner surface and a fast heat conduction from the absorbing coating to the water through the thin copper body.

For CW use all heated parts of the load must be cooled and this is achieved by 16 electroformed spiral channels.

Both short pulse loads (0.1-1 s) and the CW version at 2 MW, 170 GHz, are described in the paper.

High power tests on short-pulse loads have been done using a double frequency gyrotron, 105 GHz/600 kW for 0.5s and 140 GHz/800 kW for 1s. Also a method for emulating 2 MW conditions while using 1 MW gyrotron has been applied for testing the load to be used for the European 2 MW coaxial cavity gyrotron development programme.