

Structural Mechanics and Material Aspects of the Next European Torus

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ABSTRACT

The materials test programmes and the structural mechanics studies being undertaken during the current pre-design phase of the Next European Torus (NET) project are described. These activities are aimed at generating the required materials data and setting up qualified analysis procedures and criteria, thereby assisting in the final selection of materials and design concepts before embarking on the detailed design of NET at the end of the present decade.

Several material options for each of the principal components have been retained for the present; for example, the main candidates for the first wall and breeder structural components are solution annealed or cold-worked 316L austenitic steel and quenched and tempered 1.4914 martensitic steel.

A large part of the structural mechanics studies during this early stage of the NET development is directed towards thermo-mechanical studies of the first wall and the development of structural evaluation criteria. Several first wall design options are compared via global analyses in which the integral bending response of the panels is addressed and through localised analyses in which geometrical singularities and different protection schemes for inhibiting plasma-wall interaction are examined.

The compilation of an interim set of criteria to be used in the structural design evaluation is essentially based on the ASME Section III and related code cases, with account also being taken of the fusion specific damage and failure modes and the NET materials, loading and environmental conditions. These preliminary criteria will be continuously up-dated as new materials data are generated in the associated research and development programmes.