



Preliminary consideration on the choice of materials for next CFETR

WAN Farong

University of Science and Technology Beijing

Type of materials in CFETR

- Blanket breeding materials
- Blanket first wall structure material
- Plasma facing materials
- Functional materials
- Other materials

Requirement for materials in CFETR

- Irradiation dose
- Heat flux loading
- Mechanical loading
- Magnetic field strength
- Main engineering features
- Industry situation in China



Problems of materials in CFETR

- Welding technology
- Cost of materials fabrication
- Resource limitation of materials
- Standard for materials design

Activities for materials design in CFETR

- To collect data of materials design in ITER
- To construct a database of materials for CFETR
- To analyze the standards for materials of China and other countries
- To decide the design method for different materials in CFETR

- Ready to start to work !
-

A sample: Standard of Materials design in ITER

Component	Key issues	Resolution
Vacuum vessel	Complicated configuration Electromagnetic force Limited accessibility for welding	Design by FEM analysis Special configurations of partial penetration T-welded joints
Replaceable in-vessel components	Complicated configuration Electromagnetic force One-sided heating with high heat flux Heavy neutron irradiation HIPed bonding or brazing	Design by FEM analysis under a limited lifetime
Superconducting coils	Complicated configuration Electromagnetic force Cryogenic operation	Design by FEM analysis with a new design allowable stress limits
Tritium plant components	Low pressure operation	Reasonable requirement on examination / inspection

Development of materials for CFETR

Possible activities

- **component design, selection and development of qualified materials and joining techniques**
- **manufacturing and testing of small scale mock-ups**
- **evaluation of neutron induced material degradation**
- **transition from small scale to mid-size and full-size components**