Divertor mockup testing – KIT plans for 2012-2013

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Divertor: pipe, surrounded by tungsten

ASDEX upgrade, IPP, Garching
## Divertor matrix: coolant and material

<table>
<thead>
<tr>
<th></th>
<th>water</th>
<th>water</th>
<th>helium</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100°C – 120°C, 40 bar</td>
<td>275°C – 325°C, 160 bar (PWR)</td>
<td>400°C – 600°C, 100 bar</td>
</tr>
<tr>
<td>Cu up to 250°C</td>
<td>20 MW/m²</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Austenitic steel up to 550°C</td>
<td>5 MW/m²</td>
<td>(&lt; 5 MW/m²)</td>
<td>(1 MW/m²)</td>
</tr>
<tr>
<td>RAFM steel 350°C – 550°C/650°C</td>
<td>×</td>
<td>(5 MW/m²)</td>
<td>1 MW/m²</td>
</tr>
<tr>
<td>W-laminate Cu: 400°C – 800°C</td>
<td>×</td>
<td>×</td>
<td>10 MW/m²</td>
</tr>
</tbody>
</table>
Water-cooled divertor
H$_2$O-cooled (100°C – 120°C, 40 bar), austenitic steel

Can we remove 5 MW/m$^2$ with water and austenitic steel?
H$_2$O-cooled (100$^\circ$C – 120$^\circ$C, 40 bar), austenitic steel

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316Ti

W

Cu

1 mm

50 µm

e.g. 316Ti
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**H₂O-cooled** (100°C – 120°C, 40 bar), **austenitic steel**

- **Videos:**  W-Austenit-1#153040_3MW.avi  
  W-Austenit-2#153058_6MW.avi

- **Results:**
  - NDT possible
  - 6 MW/m², 100 cycles (20 s on, 40 s off), mockup intact

**Can we remove 5 MW/m² with water and austenitic steel?**
Helium-cooled divertor
He-cooled divertor

P1: pipe bend Eurofer
P2: excentric hull Eurofer
P3: cartridge Eurofer
P4: lamellar monoblock W plate, e.g. 0.3 mm
P5: pipe ductile W
P6: cartridge cap Eurofer
P7: pipe bend Eurofer ODS
P8: mixing tap Eurofer

1000 mm

400°C

650°C

400°C

500°C

20 mm

Literature:
He-cooled divertor

W lamellar monoblock

austenitic steel

W pipe made of W foil

10 mm

austenitic steel
He-cooled divertor

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He-cooled divertor

pipe made from a rod

pipe made of tungsten foil
He-cooled divertor

- Austenitic steel
- W pipe made of foil (AgCu)

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Thank you for your attention

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