Development of deuterium-loaded targets for D-D neutron generator based on high-current gasdynamic ECR ion source.

Ivan Izotov, Vadim Skalyga
IAP/RAS, Nizhny Novgorod, Russia

Motivation
Modern accelerator facilities require high current pulsed/CW H⁺/D⁺ beams with excellent emittance

SMIS-37 facility at IAP

Gyrotron 37 GHz, 10-80 kW, 1ms/1Hz Gasdynamic plasma confinement

- High plasma density >2*10¹³ cm⁻³
- High collision rate -> Low plasma lifetime ~tens of µs
- Plasma flux at the mirror point >10 A/cm²
- T_e ~ 20-300 eV -> close to 100% ionization
- Ti ~ 1-5 eV + extraction in the area of low magnetic field -> excellent emittance

High efficiency targets able to survive 100 kW beam are needed!

Experimental facility for target production

- High vacuum down to 10⁻⁶ Torr
- Hydrogen/deuterium pressure up to 2 bar
- RGA analysis
- Water-cooled viewport
- Target heater with programmable temperature sequence
- Temperature/pressure control

<table>
<thead>
<tr>
<th>Target</th>
<th>Neutrons per 1 mA</th>
<th>Total neutron flux, 1/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>TiD₂ (IAP)</td>
<td>7·10⁵</td>
<td>2·10⁸</td>
</tr>
<tr>
<td>TiD₂ (Factory)</td>
<td>1·10⁶</td>
<td>3·10⁸</td>
</tr>
<tr>
<td>D₂O</td>
<td>4·10⁶</td>
<td>10⁹</td>
</tr>
</tbody>
</table>

Neutron flux of up to 2*10⁸ 1/s achieved while bombarding produced target with 500 mA of pulsed deuterium beam.

Results of SIMS analysis and K-alpha characteristic emission (electron microscope) showed that thin surface layer of oxygen reduces target performance.