Study of the neutron flux of NG-24m Neutron Generator

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Neutron diagnostics system should be calibrated using close to operational in-vessel conditions. Creating such conditions requires neutron source with known parameters. These parameters include spatial distribution of neutron flux and neutron energy around emission point.

During the study the above mentioned parameters were measured for a neutron generator NG-24M in different operating modes using CVD-diamond detectors. Direction diagram was plotted. Based on experimental data several inferences about generator tube gas composition were made.

As a part of experiment the process of CVD-diamond detector calibration using α-particle 226Ra source was conducted and documented.

Conclusions:

Operating modes of NG-24M rest beyond the documented range of accelerating potential and tube current, which allows for obtaining a greater quantity of neutron flux value.

Neutron energies measured on the axis of neutron generator lay between 14,71 and 14,87 MeV for 100 and 200 kV accelerating potential values, respectively. Experimental neutron energy agrees with theoretical neutron energy with great accuracy for accelerating potential of 200 kV.

Experimental data implies that generator tube gas consists essentially of molecular deuterium and tritium ions. This fact should be considered whilst estimating spatial distribution of neutron flux.

Spatial anisotropy of the neutron flux was shown. Alongside the neutron generator target plane the spatial anisotropy is driven by the “shadow” of neutron generator vessel.

Neutron flux value in certified spatial point was derived using CVD-diamond detector. This value agrees with the one derived using neutron activation method with good accuracy (~5%).

NG-24m neutron generator demonstrates pecise operating mode adjustment thus allowing the attaining of different neutron flux and energy values. The ability of creating similar to an operating tokamak conditions should also be taken into account.

