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# Detailed study of the neutron scattering from highly oriented pyrolytic graphite

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Pyrolytic graphite (PG) has a high Bragg reflectivity for neutrons and is therefore much used for monochromators and analyzers in all types of backscattering and triple-axis spectrometers (TAS).

PG can also be the source of background signals since it has low velocity phonon branches. If interpreted as Bragg scattering, these phonon branches will appear as broad spurious background signals. This has led to some backscattering instruments installing cooling to obtain better signal background ratio, but the need for cooling for TAS is disputed.

We here present an investigation of the total scattering features of PG at different temperatures. We used a diffractometer to obtain a 2D scattering map of a PG analyzer crystal. Intensities span 5 orders of magnitude and consist of Bragg diffraction, powder rings, phonon scattering and surprisingly also a signal that appears as specular reflectivity at high q.

We present a model of all features in the data using McStas UNION, and a new general Born-von Karman phonon description for McStas, we can effectively map scattering features in instruments as a function of both temperature and nominal analyzer energy. Our results show that while backscattering instruments do need cooling, TAS do not, due to a different orientation of the phonon scattering cloud. We argue that our McStas model will be useful to investigate scattering geometries of a wide range of instruments and determine possibilities of spurious signals and phonon contamination.

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