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Towards a gas filtration setup for future ultra-sensitive SF6 gas based rare-event physics experiments.

The gas SF_6 has become of interest as a negative ion drift gas for use in directional dark matter searches. However, as for other targets in such searches, it is important that contamination can be removed, because problems with signal detection can arise from contaminants such as radon and impurities. Radon contamination can produce unwanted background events, and impurities such as water and nitrogen can capture interaction-produced electrons, preventing these electrons from detection. In this work, we demonstrated the filtration of radon (up to 87%), water (up to 79%) and nitrogen (up to 89%) from SF_6 by using Sigma-Aldrich molecular sieves. The filtration of contaminants were investigated in separate experiments using a *DURRIDGE* RAD7 for radon detection and a *Hiden Analytical* residual gas analyser for monitoring impurities. A molecular sieve filtration system for an SF_6 gas-based experiment has been designed. This system is planned to be tested with a miniature Multi-Wire Projection Chamber (MWPC), which contains SF6, to quantify the efficiency of the molecular sieve in reducing gain deterioration due to contaminants over time. In addition to benefits in signal detection, the molecular sieve filtration system can also be applied to reduced the amount of SF_6 used by purifying and recycling it. This is a step towards reducing the amount of SF_6 , the most potent greenhouse gas, planned for use in future large scale directional dark matter experiments.

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