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Molecular sieve-based gas recycling system with radon reduction for rare-event gaseous detectors

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A new molecular sieve-based gas recycling system is presented that provides for simultaneous removal of both radon and common impurities from $\text{SF}_6:\text{CF}_4:\text{He}$ gases in TPCs, hence minimising the total amount of gas required. Removal of internally-produced radon and associated progeny is important for background suppression whilst removal of outgassing and leaked-in contaminants such as water, oxygen and nitrogen is required to suppress capture of interaction-produced electrons which causes gain suppression. The system utilises a Vacuum Swing Adsorption (VSA) technique, allowing continuous long-term operation. Studies are presented of a new low radioactive molecular sieve, developed for this work and found to emanate radon up to 98% less per radon captured than commercial material.

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