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Recuperation systems for fluorinated gases at the CERN LHC Experiments

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Particle detectors at the LHC experiments are very often characterized by large detector volumes and by the need of using very specific gases, some of which are greenhouse gases (GHGs). Given their high Global Warming Potential (GWP) and the increasingly stringent European regulations regarding the use and trade of these gases, CERN is today strongly committed to reduce GHGs emissions from particle detector operation. Different approaches have been adopted for reducing the GHG emissions. To achieve this objective, the CERN Gas Team has developed gas recuperation plants: i.e. systems designed to extract GHGs from the exhaust of gas recirculation systems allowing further re-use and, therefore, reducing drastically GHGs emissions without changing detectors operation conditions. They are industrial-scale systems, each of which relies on different principles for gas separation and purification. Considering the unique gas mixtures used in particle detectors, these recuperation systems have been specifically developed as no industrial apparatus currently exists to address these requirements. Recent developments are concerning plants for recuperation of CF4, C2H2F4 (also called R134a), SF6 and C4F10, which are used respectively for Cathode Strip Chambers, (CSCs) Resistive Plate Chambers (RPCs) and Ring-Imaging Cherenkov (RICH) detectors. The separation of fluorinated gases is carried out mainly through membranes, absorbers, or distillation. In the case of CF4, it is separated from a CF4/Ar/CO2 mixture (in the proportions of 10/40/50). The R134a is recuperated from a gas mixture of C2H2F4/iC4H10/SF6 (in the proportions of 95.2/4.5/0.3) where freon forms an azeotropic mixture with the iC4H10. The C4F10 is separated from CO2, O2 and N2. It is worth to notice that these gas mixtures undergo high electric field and high radiation background characteristic of the LHC experiments and therefore dedicated studies on the breakdown products have also been performed.

Collaboration

Role of Submitter

I am the presenter

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