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Recent Progress in Silica Aerogel Cherenkov Radiator

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We reported on a successful production of hydrophobic silica aerogels with a wide range of refractive index, 1.0026 < n < 1.26 in the previous TIPP09 conference. Since then highly transparent aerogels with high refractive index have been especially developed by a new production method: pin-drying method. This significant progress opens up wide opportunities to employ aerogels in Cherenkov counter. In the coming high energy and nuclear physics experiments at KEK, many groups are considering Cherenkov counters utilizing an aerogel as a radiator and some of them are already in the detailed design stage.
For the Belle II experiment at SuperKEKB, we are developing a proximity-focusing aerogel ring-imaging Cherenkov detector (ARICH) to separate kaons from pions at 1-4 GeV/c in the forward end-cap. We are planning to introduce the most transparent aerogels with n = 1.05-1.06, and large tile production using both the conventional KEK method and the pin-drying method has been tested. Optical quality as well as tile handling for crack-free samples was investigated in detail, and we have obtained hydrophobic aerogels with excellent properties of large size (18*18*2 cmˆ3), high refractive index (n = 1.05) and high transmission length (over 40 mm).
In addition, a lot of nuclear physics experiments proposed/approved at J-PARC indicated high demands to implement on-line aerogel threshold Cherenkov counters for triggering purpose. For example, E03 (measurement of Xiˆ- atomic X rays) requires n = 1.12 to trigger positive kaons from protons at 1-2 GeV/c, and E16 upgrade plan shows importance of Cherenkov counter with n = 1.034 for a kaon spectrometer. E27 (search for Kˆ-pp state) also requires n = 1.25 to separate kaons from high momentum protons. Aerogels with n = 1.12 have already manufactured to install a counter by the pin-drying method, and aerogels with n = 1.25 are under test mass production by the same method. Although aerogels with n = 1.034 are produced by the conventional method, the transparency is expected to increase by a recent development.
In the presentation, the development and manufacturing status of these aerogel Cherenkov radiators based on these studies are reported.

Author: Dr TABATA, Makoto (Japan Aerospace Exploration Agency (JAXA))

Co-authors: Prof. KAWAI, Hideyuki (Chiba University); Prof. ADACHI, Ichiro (High Energy Accelerator Research Organization (KEK)); Mr KUBO, Masato (Chiba University); Mr SATO, Takeshi (Chiba University)

Presenter: Dr TABATA, Makoto (Japan Aerospace Exploration Agency (JAXA))

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