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C1Po2A-03 [22]: Hydrogen contaminations in liquid helium

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For some years now, massive problems are often occurring when operating standard flow cryostats with pumped liquid helium. There are a large number of reports from various parts of the world, describing blockage problems arising typically within a few hours. Standard equipment for measuring the physical properties at temperatures below 4K is massively affected.

Hydrogen contaminations within the used liquid helium could be identified as direct cause. With helium evaporating in the narrow throttling passages, hydrogen in solid state accumulates and is forming blockages. Usually internal capillaries or inlet valves are concerned. In consequence, the helium flow is reduced or ceasing completely, the operating temperature of the cryostat can't be uphold, and the measurement run must be interrupted. Extremely low concentrations, e.g. in the ppm or sub-ppm range, are sufficient to block the helium flow within a few hours of operation.

This contribution contains first quantifications regarding these contaminations. Both, a semi-quantitative analysis method using a narrow flow resistance, as well as gas chromatographic investigations led to new findings. Effects within the liquid helium supply that give rise to the problem were scrutinized. Possible remedies are discussed. The collected results should lead to an understanding and to feasible solutions of the problem.

Keywords:

Liquid helium, Hydrogen contamination, Flow cryostat, Blockade of capillaries, Blockage of valves

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