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NASA TECH BRIEF

John F. Kennedy Space Center

Transfer of Gaseous Oxygen From High-Pressure Containers and the Joule-Thomson Inversion

The Joule-Thomson inversion associated with the transfer of gaseous oxygen from high-pressure containers has not been explored beyond pressure of 5000 psig (34.4×10^6 N/m^2). As a result, a study was performed to determine this point in the 3000- to 10,000-psig (20.6×10^6- to 68.9×10^6-N/m^2) pressure range at flow rates ranging from 24.5 to 1300 standard cubic feet per minute (0.7 to 36.8 m^3/min). The transfer process in this study was assumed to be a constant enthalpy throttling process.

Normally, when gases are throttled at high pressures, there is a drop in temperature in the downstream gas. This occurs when Joule-Thomson coefficient μ is positive. However, at sufficiently-high upstream pressures, the coefficient can become negative and the gas will heat up. The pressure and temperature at which μ changes signs is the Joule-Thomson inversion point.

From the experiments performed in the study, it was determined that oxygen transferred at ambient temperature and pressures up to 10,000 psig (68.9×10^6 N/m^2) consistently dropped in temperature. All results therefore indicate that gaseous oxygen transferred at ambient temperature does not exhibit the Joule-Thomson inversion below 10,000 psig.

Note:

Requests for further information may be directed to:

Technology Utilization Officer
Kennedy Space Center
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NASA has decided not to apply for a patent.

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