Joule–Thomson coefficient

@wikipedia

The rate of change of temperature T with respect to pressure P in a throttling process:

(1) $$\epsilon_{JT} = \left(\frac{\partial T}{\partial P}\right)_H = \frac{\alpha_V \cdot T - 1}{c_{vp}}$$

where

T	Temperature
α_V	Thermal expansion coefficient
c_{vp}	Isobaric volumetric heat capacity

For the Ideal Gas: $\alpha_V = \frac{1}{T}$ and Joule–Thomson coefficient is strictly zero: $\epsilon_{\mathrm{JT}} = 0$.

In case of general Fluid: $\alpha_V = \alpha_V(T)$ and the temperature T_{inv} where $T_{\mathrm{inv}} \cdot \alpha_V(T_{\mathrm{inv}}) = 1$ is called Inversion Temperature.

The Fluid above Inversion Temperature $T > T_{\mathrm{inv}}$ has negative Joule–Thomson coefficient $\epsilon_{JT} < 0$ and hence will be cooling under expansion ($\delta P > 0$).

The Fluid below Inversion Temperature $T < T_{\mathrm{inv}}$ has positive Joule–Thomson coefficient $\epsilon_{JT} > 0$ and hence will be warming under expansion ($\delta P > 0$).

See also

Physics / Thermodynamics / Thermodynamic process / Throttling Temperature Effect