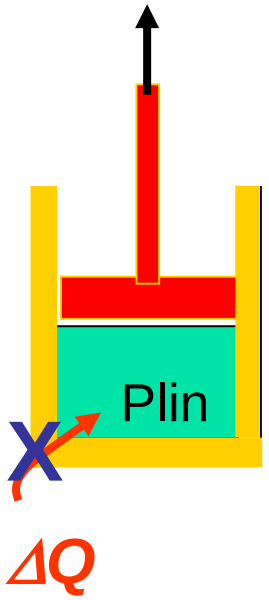
- Adijabatski procesi



Odvijaju se u zatvorenim sustavima koji ne dozvoljavaju razmjenu topline s okolinom (toplinski dobro izolirani) ali dozvoljavaju razmjenu rada

$$\Delta U = Q + W$$

$$Q = 0$$

$$\Delta U = W$$

$$dU = \delta W$$

Pretpostavka: idealni plin; reverzibilna ekspanzija
(vanjski i unutarnji tlak su jednaki)

$$dU = \left(\frac{\partial U}{\partial V}\right)_T dV + \left(\frac{\partial U}{\partial T}\right)_V dT$$

$=0$ $\quad$ C_V

$$C_V dT = -p dV$$

$$p = \frac{nRT}{V}$$

$$C_V dT = -nRT \frac{dV}{V} \qquad /T$$

$$C_V \frac{dT}{T} = -nR \frac{dV}{V} \qquad /C_v$$

$$\frac{dT}{T} = -\frac{nR}{C_V} \frac{dV}{V}$$

$$C_{V,m}$$

$$\frac{dT}{T} = -\frac{R}{C_{V,m}}\frac{dV}{V}$$

/ $\int$

$$\int_{T_1}^{T_2} d\ln T = -\frac{R}{C_{V,m}}\int_{V_1}^{V_2} d\ln V$$

$$\ln\frac{T_2}{T_1} = -\frac{R}{C_{V,m}}\ln\frac{V_2}{V_1}$$

$$C_{p,m} - C_{V,m} = R$$

$$\ln\frac{T_2}{T_1} = -\frac{(C_{p,m} - C_{V,m})}{C_{V,m}} \ln\frac{V_2}{V_1}$$

$$\frac{C_{p,m}}{C_{V,m}} = \gamma$$

Poissonov koeficijent

$$\ln\frac{T_2}{T_1} = (\gamma - 1)\ln\frac{V_1}{V_2}$$

Jednoatomni plinovi

$$\gamma = \frac{\frac{5}{2}R}{\frac{3}{2}R} = 1{,}67$$

Dvoatomni plinovi

$$\gamma = \frac{\frac{7}{2}R}{\frac{5}{2}R} = 1{,}40$$

$$\ln \frac{T_2}{T_1} = (\gamma - 1) \ln \frac{V_1}{V_2}$$

$$\frac{T_2}{T_1} = \left(\frac{V_1}{V_2} \right)^{(\gamma - 1)}$$

$$T_1 V_1^{\gamma - 1} = T_2 V_2^{\gamma - 1} = T V^{\gamma - 1} = konst.$$

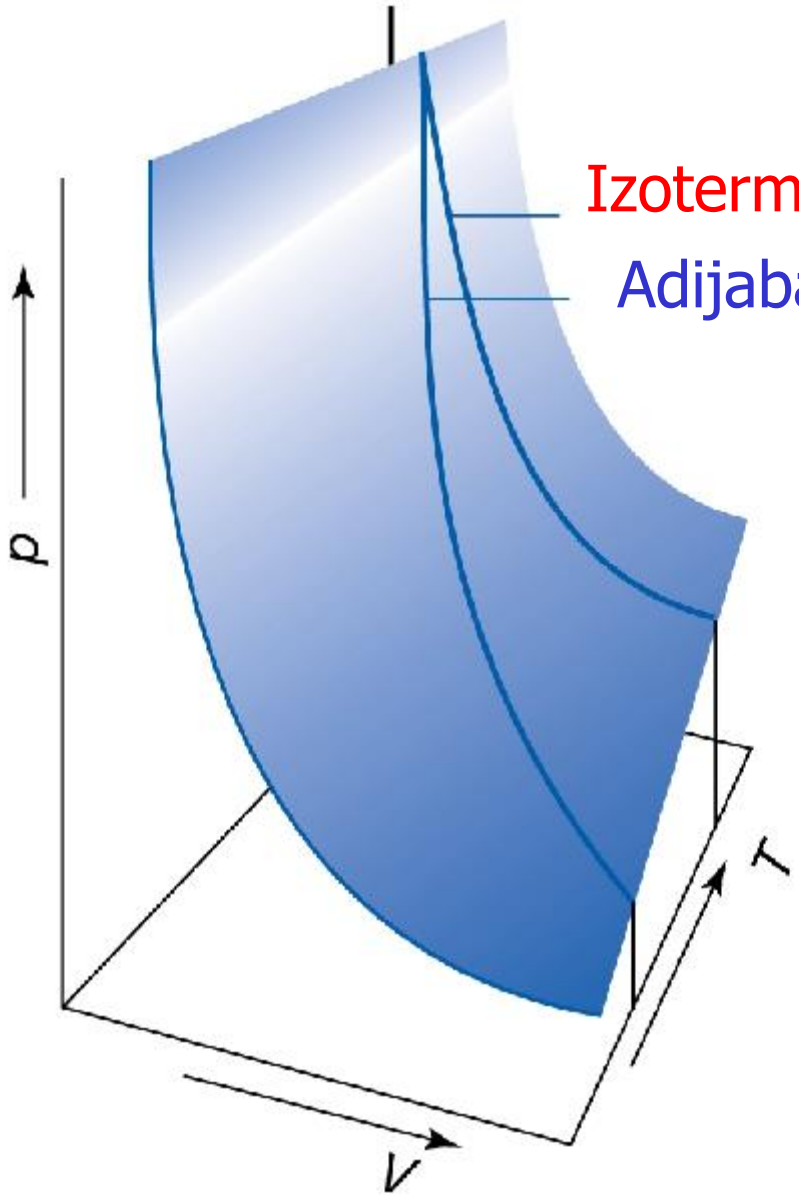
$$\frac{p_1 V_1}{T_1} = \frac{p_2 V_2}{T_2}$$

$$\frac{T_2}{T_1} = \left(\frac{V_1}{V_2}\right)^{(\gamma-1)}$$

$$\frac{T_2}{T_1} = \frac{p_2 V_2}{p_1 V_1} = \left(\frac{V_1}{V_2}\right)^{(\gamma-1)}$$

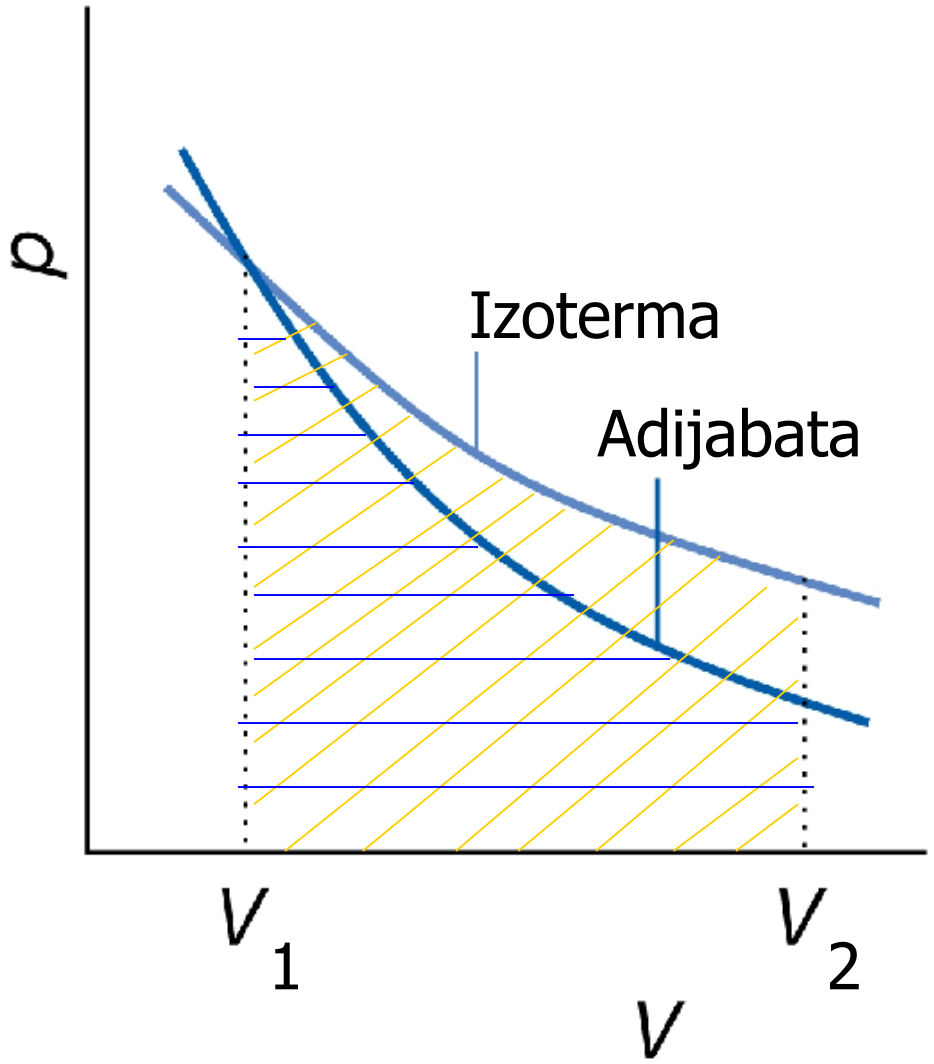
$$\frac{p_2}{p_1} = \frac{V_1}{V_2}\left(\frac{V_1}{V_2}\right)^{(\gamma-1)} = \frac{V_1^{\gamma}}{V_2^{\gamma}}$$

$$p_1 V_1^{\gamma} = p_2 V_2^{\gamma} = p V^{\gamma} = konst.$$



p V= konst.

$$pV^{\gamma} = konst.$$



Plin se pri adijabatskoj ekspanziji hladi a pri adijabatskoj kompresiji grije

$$W_{adij.} < W_{izotermni}$$

$$\delta W = -pdV$$

$$\delta W = -nRT\frac{dV}{V} \qquad / \int$$

$$W_{adij} = -nR\int T\frac{dV}{V}$$

mijenja se pri adijabatskoj promjeni

$$TV^{\gamma-1} = konst.$$

$$\ln T + (\gamma - 1)\ \ln V = \ln konst. \qquad / dif.$$

$$\ln T + (\gamma - 1)\ \ln V = \ln konst. \qquad / dif.$$

$$\frac{dT}{T} + (\gamma - 1)\frac{dV}{V} = 0$$

$$\frac{dV}{V} = -\frac{1}{(\gamma - 1)}\frac{dT}{T}$$

$$W_{adij} = -nR\int_{T_1}^{T_2} T\left(-\frac{1}{(\gamma - 1)}\right)\frac{dT}{T}$$

$$W_{adij.} = \frac{nR}{(\gamma - 1)}(T_2 - T_1)$$

$T_2 < T_1$!!!

Za idealni plin!

$$\frac{n(C_{p,m} - C_{V,m})}{\left(\frac{c_{p,m}}{c_{V,m}} - 1\right)} = \frac{n(C_{p,m} - C_{V,m})}{\frac{C_{p,m} - C_{V,m}}{C_{V,m}}} = nC_{V,m} = C_V$$

$$W_{adij.} = C_V \Delta T$$