

STATISTICAL MOLECULAR THERMODYNAMICS

Christopher J. Cramer

Video 1.1

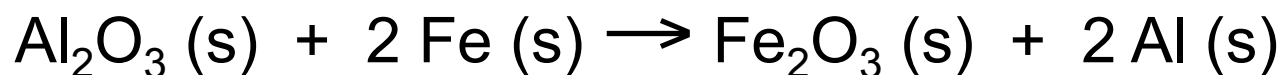
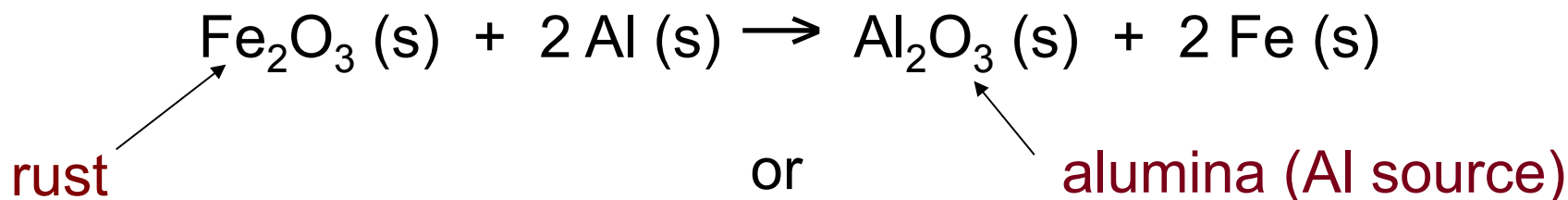
That Thermite Reaction

IF YOU WANT TO BUILD A HOUSE...



*...first you've got to
build a hammer*

THERMITE REACTION

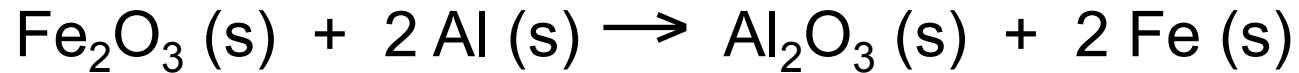


Which way does this reaction go? Why?

Will the metal that is produced melt? How do you know?

The energetics of reactions are important for all chemical processes! For example: H₂SO₄, polyethylene, pharmaceuticals, soaps, food products, petroleum cracking, biochemical processes, etc.

THERMITE REACTION — EXOTHERMIC



assess change in *enthalpy* for a given direction

$$\Delta H_{rxn} \approx -850 \text{ kJ/mol} = -850,000 \text{ J/mol}$$

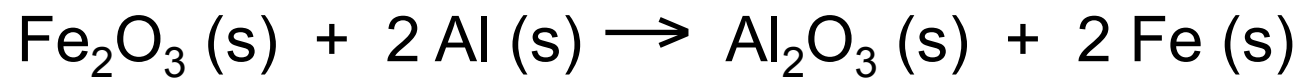
Released heat can raise temperature and melt solids

$$\Delta H_{fus}(\text{Fe}) \approx 14 \text{ kJ/mol} \quad \Delta H_{fus}(\text{Al}) \approx 11 \text{ kJ/mol}$$

$$C_p (\text{Fe}) \approx 25 \text{ J/mol}\cdot^\circ\text{C} \quad C_p (\text{Al}_2\text{O}_3) \approx 128 \text{ J/mol}\cdot^\circ\text{C}$$

Adiabatic temperature rise? $T > 2,500 \text{ }^\circ\text{C}$! $MP (\text{Fe}) = 1530 \text{ }^\circ\text{C}$

HEAT SUITABLE FOR WELDING



*Enthalpy, heat capacity, entropy, free energy....that's **THERMODYNAMICS!***