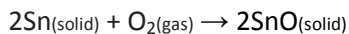


I don't know, how to explain that SnO formation from its elements is thermodynamically favorable. I think it must be redox because that's how we explain thermodynamic favorable equations. But I don't know if I can use water molecules because it says "from its elements".

Solution: Such explanation should be based on the sign of the Gibbs free energy change for the reaction of SnO formation from elements in standard state (298 K, 1.013 bar):



$\Delta G = \Delta H_r - T \cdot \Delta S_r$ , where  $\Delta G$  – Gibbs free energy change, kJ, if  $\Delta G < 0$ , then this reaction is thermodynamically favorable;  $\Delta H_r$  – reaction enthalpy change, kJ,  $\Delta H_r = \sum(\Delta_f H_i^\circ \cdot n_i)_{\text{products}} - \sum(\Delta_f H_i^\circ \cdot n_i)_{\text{reagents}}$ , where  $\Delta_f H^\circ$  – standard enthalpy change of formation of substance, kJ/mol;  $n$  – substance amount, mol;  $T$  – absolute temperature, K;  $\Delta S_r$  – reaction entropy change, kJ/K,  $\Delta S_r = \sum(S_i^\circ \cdot n_i)_{\text{products}} - \sum(S_i^\circ \cdot n_i)_{\text{reagents}}$ , where  $S^\circ$  – standard entropy of formation of substance,  $\text{kJ} \cdot \text{mol}^{-1} \cdot \text{K}^{-1}$ ;  $n$  – substance amount, mol; All the values of  $\Delta_f H^\circ$  and  $S^\circ$  are available in handbooks.

We will not calculate the standard Gibbs free energy change of SnO formation, because it is too available in the handbooks, and it has value of  $-257.3$  kJ/mol, as you can see,  $\Delta G < 0$ , the reaction of SnO formation from its elements is thermodynamically favorable.

**Answer:** The standard Gibbs free energy change of SnO formation is negative, and then the reaction of SnO formation from its elements is thermodynamically favorable.