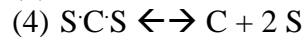
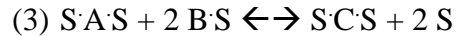
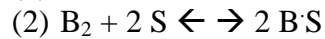
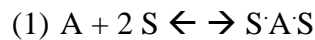
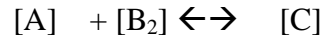
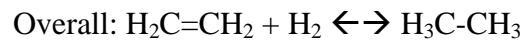


Rate Mechanisms for Catalytic Reactions

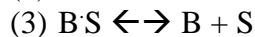
1. Consider the hydrogenation of ethylene over Palladium catalyst. From surface-science reports of ethylene and hydrogen adsorption over (111) Pd crystals, the following rate mechanism is proposed:



** assume complete coverage of active sites with either A, B or C (i.e., $[\text{S}] = 0$).

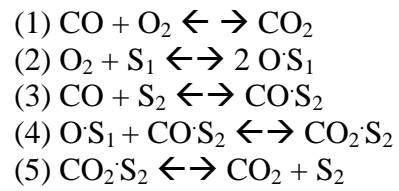
- Derive the rate expression for this reaction, assuming that adsorption of A is rate limiting.
- Derive the rate expression for this reaction, assuming that adsorption of B is rate limiting.
- Derive the rate expression for this reaction, assuming that surface reaction is rate limiting.
- Sketch the initial rate of reaction for cases (a), (b), (c) if A_0 varies, and B_0 and S_t remain constant.
- Sketch the initial rate of reaction for cases (a), (b), (c) if B_0 varies, and A_0 and S_t remain constant.
- Sketch the initial rate of reaction for cases (a), (b), (c) if S_t varies, and A_0 and B_0 remain constant.

2. Consider the isomerization of iso-butane to n-butane, which follows the mechanism,



Derive the rate expression for this reaction, assuming that there is no rate limiting step, i.e., applying pseudo-steady-state hypothesis to $\text{A}\cdot\text{S}$ and $\text{B}\cdot\text{S}$.

3. Consider the dual-site oxidation of carbon monoxide over Rh-CeO₂, which follows the mechanism:



Derive the rate expression if the surface reaction (4) is rate limiting.