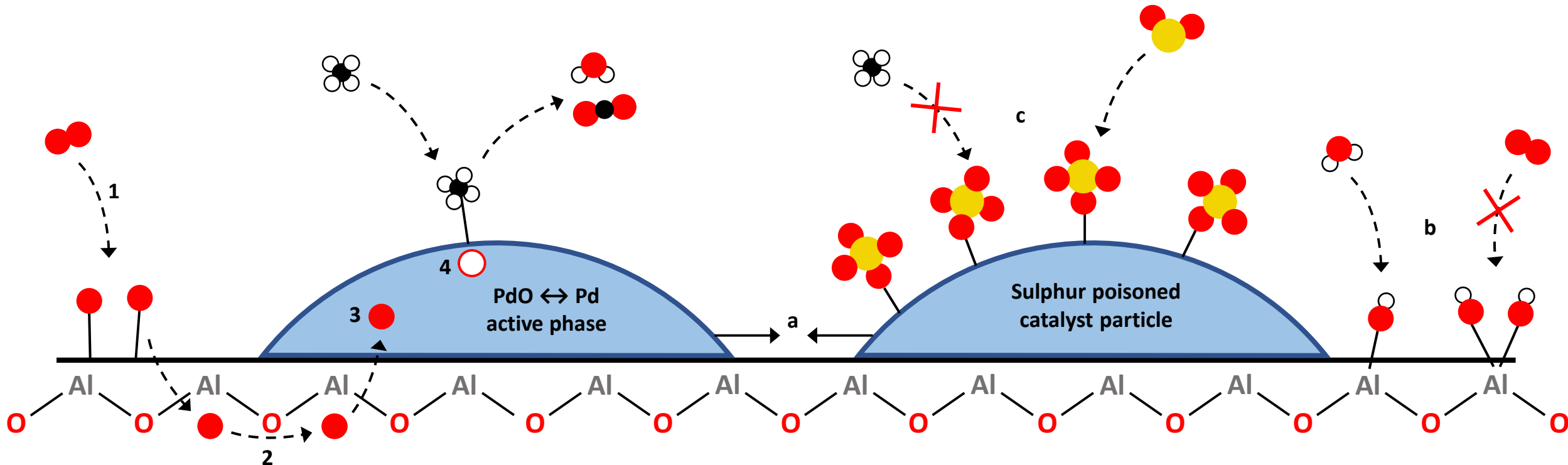


## Working principle and deactivation of classic Pd/Al<sub>2</sub>O<sub>3</sub> catalyst for complete methane oxidation



Support-assisted Mars-van Krevelen mechanism:

1. Oxygen is adsorbed on support surface
2. Oxygen is transported through support
3. Oxygen fills O-vacancies in PdO particles
4. PdO oxidizes CH<sub>4</sub>, forming new O-vacancy

Al<sub>2</sub>O<sub>3</sub> support

Deactivation in Pd-based methane oxidation catalysts:

- a) Thermal deactivation caused by metal particle sintering.
- b) Chemical deactivation caused by the presence of water which forms hydroxyls that block support oxygen uptake.
- c) Chemical deactivation caused by the presence of SO<sub>2</sub> which forms inactive PdSO<sub>4</sub> on the catalyst surface.