

## Development of Corrosion Protection Method by Cationic Species

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### Summary

At the solid-liquid interface, the electrolyte ions, solvent, and substrate atoms are bonded to each other through various chemical and physical interactions. At the region far from the metal surface, the localization of non-adsorbed charged species and reorientation of the dipole solvent, depending on electrochemical potential, are caused by a combination of various non-covalent interactions. The non-covalent interaction with surface and cationic species will affect the industrially important reactions such as fuel cell and corrosion. We found oxidation processes of a Pt(111) electrode depend on non-specifically adsorbed ions in alkaline electrolyte using in-situ X-ray diffraction and infrared spectroscopic measurements. In LiOH, the  $\text{OH}_{\text{ad}}$  adlayer is formed at the first oxidation step of the Pt(111) electrode as a result of the strong interaction between  $\text{Li}^+$  and  $\text{OH}_{\text{ad}}$ , whereas Pt oxidation proceeds without  $\text{OH}_{\text{ad}}$  formation in CsOH. Structural analysis by X-ray diffraction indicates that  $\text{Li}^+$  is strongly protective against surface roughening caused by subsurface oxidation. Although  $\text{Cs}^+$  is situated near the Pt surface, the weak protective effect of  $\text{Cs}^+$  causes the surface roughening irreversibly due to subsurface oxidation. Different oxidation processes depending on the alkali metal cation are caused by the strength of coordinate interaction between the alkali metal cation and the oxygen lone pair of adsorbed species. Especially strong interaction of  $\text{Li}^+$  protects the atomically flat surface from roughening by further internal oxidation.