

## Description of Additional Supplementary Files

File Name: Supplementary Movie 1

Description: Evolution of a surface chemical pattern on a Rh(13 9 1) domain as obtained by in situ scanning photoelectron microscopy (SPEM) during catalytic hydrogen oxidation at  $T = 453\text{ K}$ ,  $p_{\text{O}_2} = 1.1 \times 10^{-6}\text{ mbar}$  and  $p_{\text{H}_2} = 1.2 \times 10^{-6}\text{ mbar}$ . Field of view of  $41 \times 41\ \mu\text{m}^2$ .