

Zeitschrift: Helvetica Physica Acta
Band: 62 (1989)
Heft: 6-7

Artikel: Oxygen induced reconstruction of Ag(110)
Autor: Bracco, G. / Tatarek, R. / Tommasini, F.
DOI: <https://doi.org/10.5169/seals-116114>

Nutzungsbedingungen

Die ETH-Bibliothek ist die Anbieterin der digitalisierten Zeitschriften auf E-Periodica. Sie besitzt keine Urheberrechte an den Zeitschriften und ist nicht verantwortlich für deren Inhalte. Die Rechte liegen in der Regel bei den Herausgebern beziehungsweise den externen Rechteinhabern. Das Veröffentlichen von Bildern in Print- und Online-Publikationen sowie auf Social Media-Kanälen oder Webseiten ist nur mit vorheriger Genehmigung der Rechteinhaber erlaubt. [Mehr erfahren](#)

Conditions d'utilisation

L'ETH Library est le fournisseur des revues numérisées. Elle ne détient aucun droit d'auteur sur les revues et n'est pas responsable de leur contenu. En règle générale, les droits sont détenus par les éditeurs ou les détenteurs de droits externes. La reproduction d'images dans des publications imprimées ou en ligne ainsi que sur des canaux de médias sociaux ou des sites web n'est autorisée qu'avec l'accord préalable des détenteurs des droits. [En savoir plus](#)

Terms of use

The ETH Library is the provider of the digitised journals. It does not own any copyrights to the journals and is not responsible for their content. The rights usually lie with the publishers or the external rights holders. Publishing images in print and online publications, as well as on social media channels or websites, is only permitted with the prior consent of the rights holders. [Find out more](#)

Download PDF: 08.08.2025

ETH-Bibliothek Zürich, E-Periodica, <https://www.e-periodica.ch>

OXYGEN INDUCED RECONSTRUCTION OF Ag(110)

G.Bracco and R.Tatarek, Dipartimento di Fisica, I-16146 Genova, Italy

F.Tomasini, Dipartimento di Fisica, I-34127 Trieste, Italy

G.Vandoni, Dipartimento di Fisica, I-20133 Milano, Italy

Abstract: The phonon spectrum of the (2x1)O-Ag(110) surface along the $\bar{\Gamma}\bar{X}'$ direction of the overlayer is studied by He inelastic scattering with time-of-flight detection. The Rayleigh mode behaviour strongly supports the occurrence of an oxygen induced reconstruction of the Ag(110) surface.

The Ag(110) surface is well known to be an unique catalyst for ethylene epoxidation. Moreover, the catalytic action is significantly promoted by the presence of preadsorbed oxygen, which strongly increases the sticking coefficient for ethylene without participating in the oxidation reaction. Therefore, several studies to characterize structures, electronic states and vibrational modes of the chemisorbed oxygen phases were performed [1]. In spite of the large number of experimental and theoretical works on the subject, some questions still remain in debate. To shed light on some of these questions, the (2x1)O-Ag(110) vibrational spectrum was measured by He beam energy-loss spectroscopy. The experimental technique, the layer formation method and the surface phonon dispersion curves along the $\bar{\Gamma}\bar{Y}'$ direction of the overlayer were described elsewhere [2]. Briefly, an overall softening of the Ag(110) surface phonon spectrum after oxygen chemisorption was observed. In this paper, first results along the $\bar{\Gamma}\bar{X}'$ azimuthal direction are presented. Fig.1a) shows a typical time-of-flight (TOF) spectrum measured with surface temperature $T_s = 300^{\circ}\text{K}$. The incoherent elastic peak E and some structures associated to surface phonon creation/annihilation events are observed (time delay > 0 and < 0 respectively). In particular, structures denoted by S_1 describe a Rayleigh mode which appears to be extremely stiffened with respect to the same Ag mode [3]. To appreciate this the same TOF spectrum is plotted in an energy scale in fig.1b. The S_1 behaviour along $\bar{\Gamma}\bar{X}'$ together with the above mentioned results along $\bar{\Gamma}\bar{Y}'$ strongly support the occurrence of large structural changes induced by oxygen chemisorption. Preliminary lattice dynamical calculations performed within a model with harmonic nearest neighbor interactions seem to confirm this possibility [4].

Thus Ag looks like Ni [5] and Cu [6] with respect to the oxygen presence.

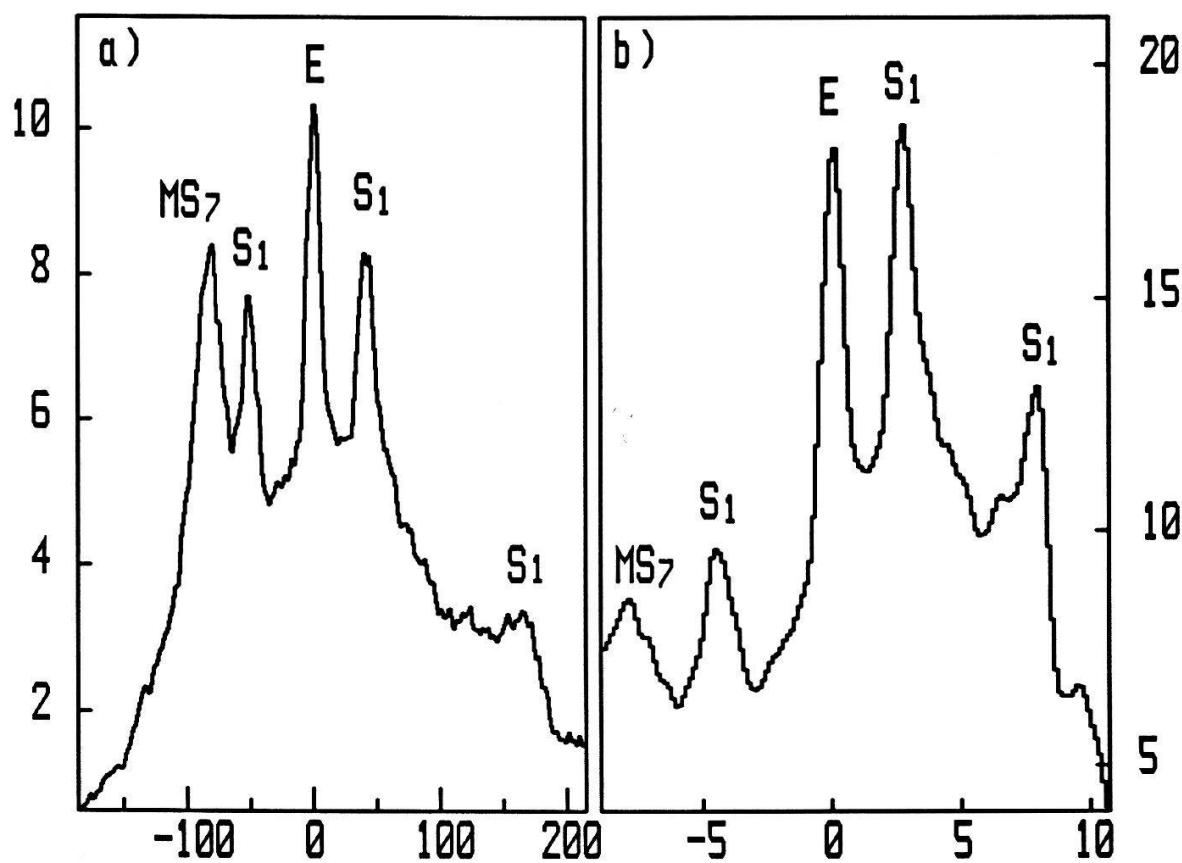


Fig.1 Scattered intensity (arb. units) versus a) time delay (μ s), b) energy loss (meV) measured with $E_{He} = 17.5$ meV, incident angle $\Theta_i = 49.9^\circ$ and scattering angle $\Theta_f = 60.4^\circ$.

References

- [1] W.Segeth, J.H.Wijngaard and G.A.Sawatzky, *Surface Sci.* **194**, 615 (1988).
- [2] G.Bracco, R.Tatarek, S.Terreni, F.Tommasini and U.Linke, *J.Electron Spectrosc.* **44**, 197 (1987).
- [3] R.Tatarek, G.Bracco, F.Tommasini, A.Franchini, V.Bortolani, G.Santoro and R.F. Wallis, *Surface Sci.*, (1989), to be published.
- [4] T.S.Rahman, private communication.
- [5] K.Baberschke, U.Doebler, L.Wenzel, D.Arvanitis, A.Baratoff and K.H. Rieder, *Phys. Rev. B* **33**, 5910 (1986).
- [6] M.Bader, A.Pushmann, C.Ocal and J.Haase, *Phys. Rev. Lett.* **26**, 3273 (1986).