§16. Scattering of Hydrogen Positive Ions on the Surface of Pt(111) and C/Pt(111)

Tsumori, K., Koppers, W.R.[1], Kadodwala, M.F.[2], Beijersbergen, J.H.M.[3], Heeren, R.M.A.[1] and Kleyn, A.W.[1]

1). FOM-institute for Atomic and Molecular Physics, Kruislaan 408, 1098SJ, Amsterdam, the Netherlands.
2). Department of Chemistry, University of Glasgow, Glasgow G12 8QQ, Scotland.
3). ASM International, 3723 BS Bilthoven, the Netherlands.

The charge states of scattered ions are very sensitive to adatom on a metal surface. In order to investigate the charge transfer process on a carbon-contaminated surface, the energy and angular distributions of scattered hydrogenous positive and negative ions have been investigated. In this experiment, hydrogenous positive ions (H_n^+ ; n=1,2,3) are individually impinged onto a Pt(111) surface and a Pt(111) with carbon overlayer, C/Pt(111). The carbon overlayer is made by exposing 1-3 butadiene onto the Pt surface at the temperature of 900 K. The thickness of the carbon layer estimated about 2.2 layers by means of XPS, but the surface site is not clear.

Figure 1 shows a difference of azimuthal dependence of scattered H^- ions before and after formation of a carbon over layer; the incident ion is H^+ and the energy is 400eV. By rotating the crystal orientation of the clean Pt sample the same structural dependence in the intensity of scattered H^- ions is obtained as that on the Ag(111) surface[1]. On the other hand, the structural profile diminishes after forming the carbon layer.

The work function of Pt(111) reduces from 5.70eV to 5.16eV by forming the carbon layer, and the yield of H^- ions increases by a factor about three. In contrast a peak height of scattered H^+ ions decreases about a half value in C/Pt(111) surface. Energy distributions of scattered H^- ions from Pt(111) ands C/Pt(111) are presented in Fig.2. The energy positions of surface peaks in scattered H^- and H^+ ions from the C/Pt surface are closer to the positions in the case of graphite surface. This shows that the incident ions are mainly scattered by carbon atoms. An additional peak of low energy is observed in scattered H^+ ions at Pt with carbon layer. By changing the outgoing angle toward the surface, this peak appears, increases and finally becomes dominant. This peak is not observed in case of scattered H^- ion.

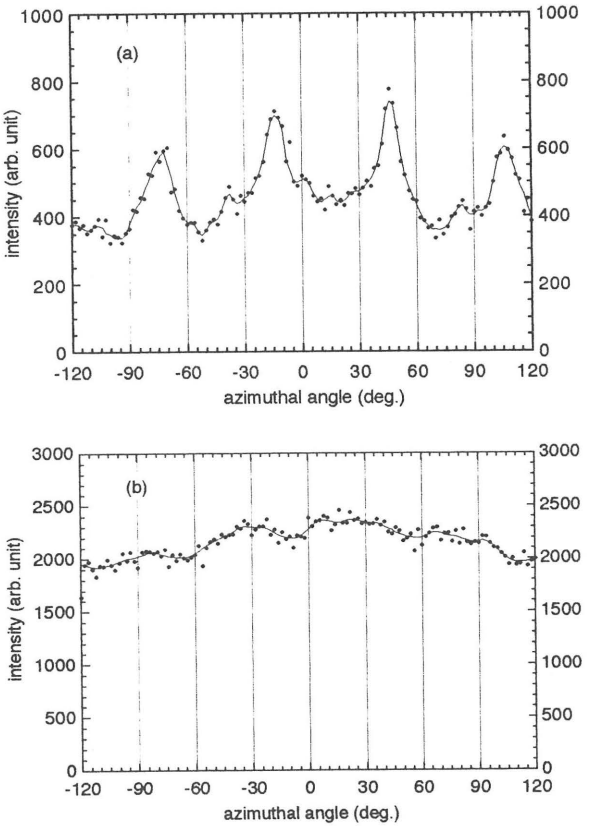

Fig. 1. Azimuthal distributions of scattered H^- ions from (a)Pt(111) and (b)C/Pt(111) surface. The energy of incident H^+ beam is 400eV, and incident and outgoing beam angles are 70° and 75° to the surface normal.

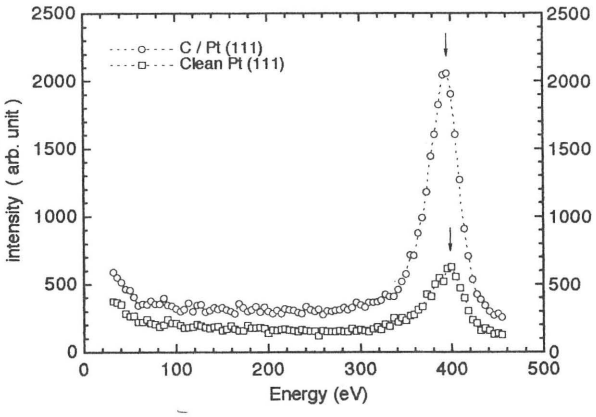

Fig. 2. Energy distributions of scattered H^- ions from Pt(111) and C/Pt(111) surface. The incident energy of H^+ beam is 400eV, and incident and outgoing angles are 70° and 75° to the surface normal.

References

1) W.R.Koppers, B.Berenbak, D.Vlachos, U. van Slooten and A.W.Kleyn
Proceedings of the Fifth European Workshop on the Production and Application of Light Negative Ions, Dublin, 23-25 March 1994.