



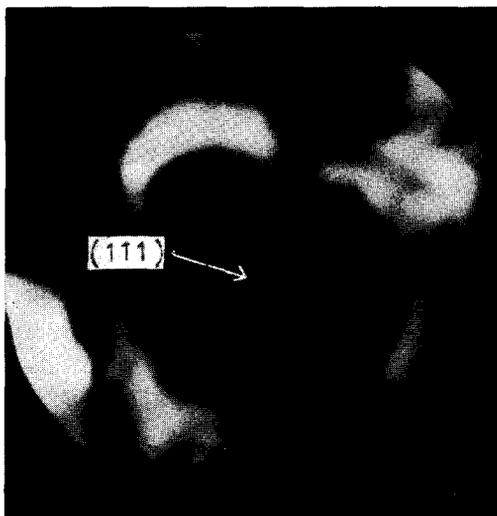
# HOKKAIDO UNIVERSITY

Title	NOTE ON THE FIELD-EMISSION MICROSCOPIC OBSERVATION OF DECOMPOSITION OF ETHYLENE ON TUNGSTEN
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**Plate 9.** After heat treatment at about 1400°K for 21 minutes,  $i=2.5 \mu\text{A}$  and  $V=6600$  volts.



**Plate 10.** After heat treatment at about 1600°K for 15 seconds,  $i=2.5 \mu\text{A}$  and  $V=7050$  volts.

## NOTE ON THE FIELD-EMISSION MICROSCOPIC OBSERVATION OF DECOMPOSITION OF ETHYLENE ON TUNGSTEN

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The field-emission pattern of a tungsten tip of about 5000 Å radius, treated with ethylene as below, was observed with  $\sim 10^5$  magnification, in a liquid oxygen filled cryostat<sup>\*\*)</sup>. Ethylene was introduced into the cell through a capillary pointed at the tip with its end 5 mm. apart from the tip. The pressure inside the cell was increased from  $\sim 10^{-9}$  to  $\sim 10^{-6}$  mm Hg by this procedure. This treatment with ethylene as well as the heat treatments described below were conducted without electric field.

<sup>\*)</sup> Research Institute for Catalysis, Hokkaido University.

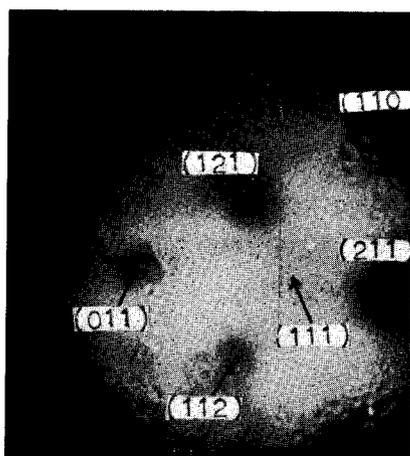
<sup>\*\*)</sup> Wrinkles shown in Plates 1 to 8 were attributed to water drops condensed on the window of the cryostat, since they disappeared as the patterns were observed without liquid oxygen.

Short Note

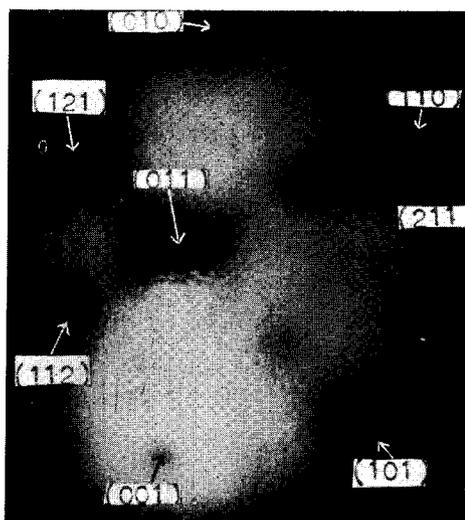
Plate 1 shows bright regions around (011)-plane of tungsten observed just after the above treatment with ethylene. The temperature of the tip was now raised to about 1550°K and then to 1950°K with the result of the emission patterns respectively of Plate 2 and Plate 3. Ethylene was now introduced again (Plate 4) and the tip was heated to about 1950°K for several minutes and more (Plates 5 and 6). The dark (334)-plane on the pattern of Plate 6 showed the known characteristic crystal plane when carbon was deposited on tungsten\*). The tip was then flashed at about 3000°K; the emission pattern thus revealed the crystal plane of carbon on tungsten (Plates 7 and 8)\*\*).

The bright region in Plates 1 and 4 might be ascribed to slightly polarised ethylene molecules ( $\text{CH}_2=\text{CH}_2^{+}$ )\*\*\*).

These observations suggest that in the high vacuum of the present experiment the decomposition of ethylene on tungsten took place rather at a high temperature, presumably around 1950°K or above.



**Plate 1.** Field-emission pattern of the ethylene adsorbed tungsten tip, at 90°K. The emission current  $i$  was  $0.65 \mu\text{A}$  and the applied voltage  $V$  was 9200 volts.



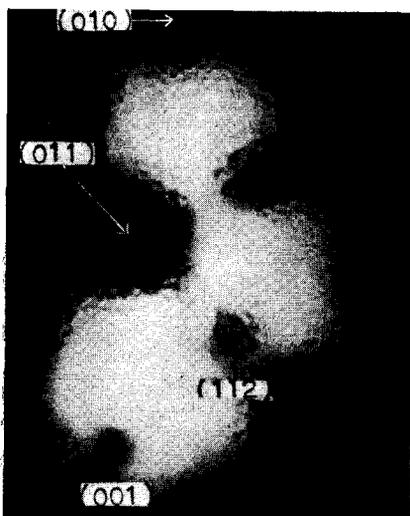
**Plate 2.** After heat treatment at about 1550°K,  $i=0.7 \mu\text{A}$  and  $V=9000$  volts.

\*) E. W. MÜLLER, *Ergebniss, exakt. Naturwiss.* XXVII, pp. 334-337 (1953).

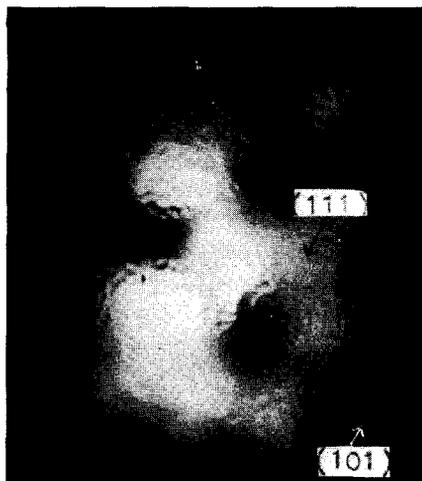
\*\*\*) R. S. MULLIKEN, *J. Am. Chem. Soc.* **74**, 811 (1952).

F. A. MATSEN, A. C. MAKRIDES and N. HACKERMAN, *J. Chem. Phys.* **22**, 1800, (1954).

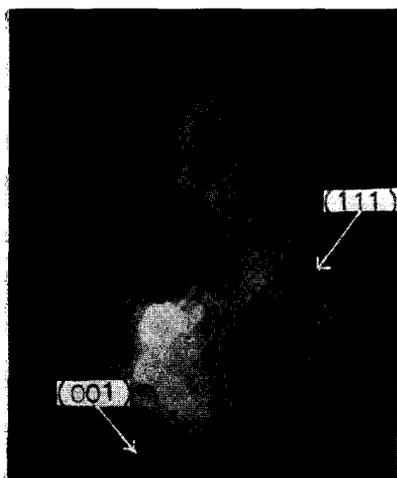
J. C. P. MIGNOLET, *J. Chem. Phys.* **21**, 1298 (1958).



**Plate 3.** After heat treatment at about 1950°K,  $i=0.5 \mu\text{A}$  and  $V=7600$  volts.



**Plate 4.** Ethylene was adsorbed on the tip again,  $i=0.6 \mu\text{A}$  and  $V=8400$  volts.

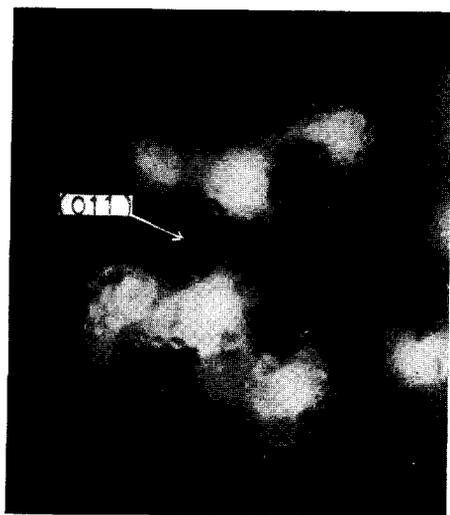


**Plate 5.** After heat treatment at about 1950°K for 5 minutes,  $i=1.5 \mu\text{A}$  and  $V=8200$  volts.

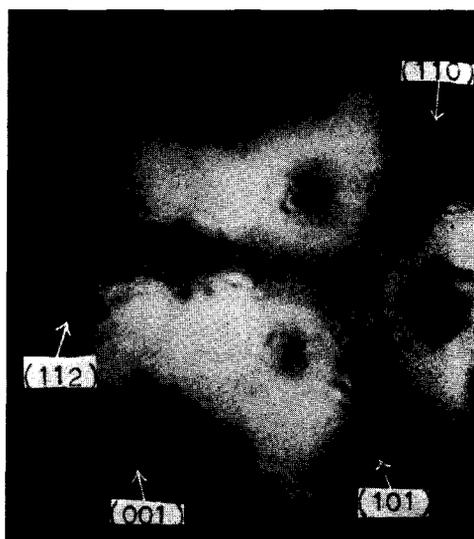


**Plate 6.** After heat treatment at about 1950°K for 10 minutes,  $i=0.5 \mu\text{A}$  and  $V=7600$  volts.

Short Note



**Plate 7.** After a flash at 3000°K,  $i=2.0$   $\mu$ A and  $V=8200$  volts.



**Plate 8.** After several flash at 3000°K,  $i=4.0$   $\mu$ A and  $V=8000$  volts.