NASA TECH BRIEF

Study Shows Effect of Surface Preparations on Improving Thermionic Emission

Specimen thermionic emitters were electropolished and electroetched as part of a program to study the effect of surface preparations on improving thermionic emission.

It was known that the best thermionic emission is achieved from the (110) plane of tungsten, and that these planes have the highest atomic density. It was also known that the highest atomic density in the rhenium lattice was found on the basal planes. Therefore, techniques were investigated which would maximize the amount of basal plane on the surface of a polycrystalline rhenium emitter. The best technique found was to electropolish the annealed rhenium surface and then electroetch it. Both operations were performed in an electrolyte consisting of:

175 ml Butanol
175 ml Methanol
175 ml Perchloric Acid (density 1.54)
50 ml Ethylene Glycol Monobutyl Ether

Electropolishing was carried out at about 30 volts, and electroetching at about 5 volts, with the specimen as anode. The effect of electroetching was to remove other crystal planes faster than basal planes, and thus maximize the amount of basal plane on the specimen surface.

The electroetching resulted in roughening of the electropolished surface; however, the increase in thermionic emission was greater than could plausibly be accounted for in terms of the increased area of the emitter surface.

Note:

Inquiries concerning this innovation may be directed to:

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Reference: B66-10493

Patent status:

No patent action is contemplated by NASA.

Source: Lawrence van Someren
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