

High emission dispenser cathodes with innovative impregnant

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ABSTRACT

The rapidly developing terahertz devices urgently require high-emission cathodes. In past 30 years, the top-layer scandate cathodes prepared by LAD[1-2] and body doped scandium oxide cathode [3-4] had greatly improved performances of scandate cathodes. However, due to complexity and high cost of these processes, the wide applications of cathodes are limited to some extent.

In order to develop a new kind of practical high-emission cathode, we proposed an idea[5] in 2013 and then continued to improve it: based on traditional impregnated dispenser cathode, designing and preparing new active substances used for the impregnation process. Now, this idea is better realized and remarkable progresses are achieved: The innovative active substance is $\text{Ba}_2\text{ScAlO}_5$ containing 3at% SrO . The precursors of the active substance was prepared by freezing sublimation technology for the first time, which made the composition distribution uniformity of the final active substance significantly better than that by mechanical mixing process. The melting point of the active substance is about 1730°C , which has good impregnation performance. In the water cooled anode planar diode test, the cathode, preparing with the new active substance ($\varnothing 1\text{mm}$, without retaining rings), showed $670\text{A}/\text{cm}^2$ emission current density under test condition (20Hz, $5\mu\text{s}$, $1100^\circ\text{C}_\text{B}$). In a terahertz electron gun tube (Fig.1), the emission current density of the cathode ($\varnothing 1\text{mm}$) reached $152\text{A}/\text{cm}^2$ under test condition (20Hz, $5\mu\text{s}$, $1090^\circ\text{C}_\text{B}$). Emission duration tests are undergoing.

Characterizations of physical and chemical properties of the active substance as well as the cathode emitting capacity demonstrated by tests show that our scheme may provide a new approach for preparation of high emission cathodes and a very promising cathode option for terahertz devices.

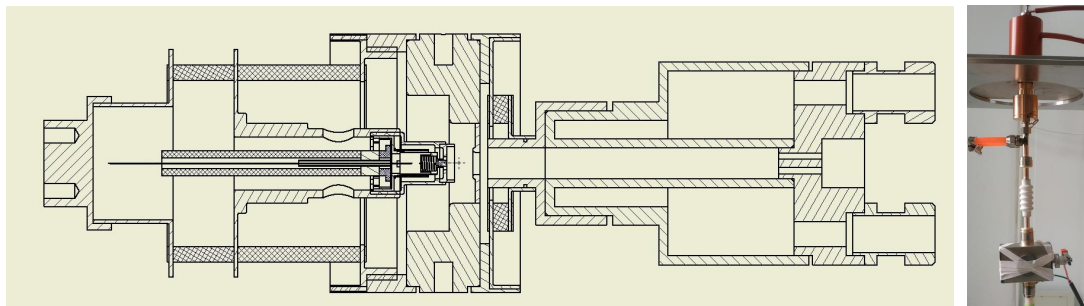


Fig1. terahertz electron gun tube with high-emission cathode($\varnothing 1\text{mm}$)

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