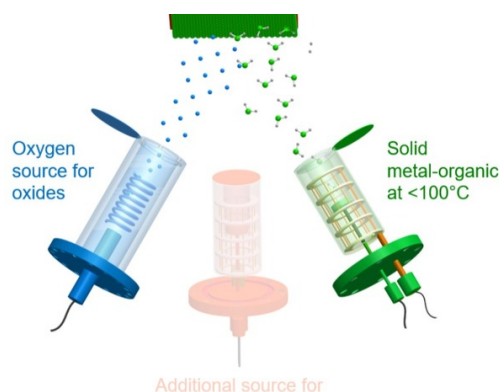
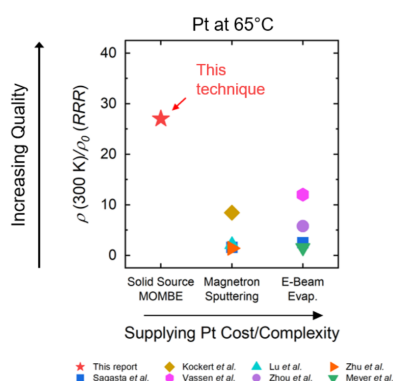




## Low-energy platinum coatings

A method for low temperature thin-film deposition of high melting point metals, like Pt, and their oxides.



Technology ID

2020-181

### Category

Engineering & Physical Sciences/Instrumentation, Sensors & Controls  
Engineering & Physical Sciences/Materials  
Engineering & Physical Sciences/Nanotechnology  
Engineering & Physical Sciences/Semiconductor  
Gap Funding/Engineering & Physical Sciences

**IP Status:** Provisional Patent Application Filed; **Application #:** 63/198,458

### Applications

- Thin-film deposition for catalysts, fuel cells, temperature sensors, electronics

### Key Benefits & Differentiators

- Reduced cost:** equipment and labor
- Low temperature:** reduce from >2000°C to <100°C
- Wider material choice** including metal-oxides
- High degree of control for complex metal-oxides**

### Technology Overview

Thin-film deposition is a fundamental step in the fabrication of components for optics, electronics, packaging, and other applications, and is expected to reach a market size of \$22 billion by 2022. Currently, the method of choice to evaporate refractory and noble metals is electron-beam physical vapor deposition (EBPVD). EBPVD involves bombardment of a target with an accelerated electron beam in high vacuum to evaporate or sublime the elemental metal of interest, which is then deposited onto a surface. Despite its ability to vaporize metals that require >2000°C, EBPVD technique is expensive. Furthermore, to obtain metal-oxide depositions, oxygen must be introduced into the chamber, which can compromise the equipment and materials and therefore the quality of deposition.

Prof. Bharat Jalan's research group at the University of Minnesota have developed a method that allows thin-film deposition of refractory or noble metals or their metal-oxides at much lower temperatures than current methods such as EBPVD. Additionally, a method for the production of thin-films of predetermined oxidized refractory metals similar to metal-organic chemical vapor deposition has been developed. The device includes a vacuum chamber

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containing an evaporation source (such as an effusion cell) enabling refractory metal thin-film deposition at low temperature using solid metal-organic substances. The potential application is the use of this system to deposit thin films of refractory metals such as platinum, iridium and ruthenium, as well as metal-oxides at the desired oxidation states in a controlled manner. The advantages of the technology are the reduced cost and the low temperature operation for thin film production compared to the current methods.

## Phase of Development

### TRL: 3-4

Working prototype. Researchers have demonstrated the growth of platinum and RuO<sub>2</sub> films at source T < 100°C, which typically requires >2500°C using conventional techniques.

## Desired Partnerships

This technology is now available for:

- License
- Sponsored research
- Co-development

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## Researchers

- [Bharat Jalan, PhD](#), Associate Professor, Chemical Engineering and Materials Science

## References

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2. Nunn, William, Sreejith Nair, Hwanhui Yun, Anusha Kamath Manjeshwar, Anil Rajapitamahuni, Dooyong Lee, K. Andre Mkhoyan, and Bharat Jalan , <https://doi.org/10.1063/5.0062726>