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## **Fast preparation of functional films by helicon-wave-excited plasma source**

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Basing on low pressure, high density helicon-wave-excited plasma (HWP) source [1], tungsten nitride [2] and carbon-based (vertical graphene nanosheets and multi wall carbon nanotube arrays) [3,4] functional films have been synthesized on silicon substrates by physical sputtering and chemical vapor deposition techniques with high deposition rate at room-temperature, respectively. The structure, composition, morphology, mechanical and electrical properties of the films have been lucubrated. Meanwhile, by monitoring the plasma parameters which are crucial for the film nucleation and growth features, such as the ion flux and energy toward the substrates and the reactive species densities near the film surface, progress has been made on comprehending the film synthesis mechanisms and understanding how the film properties can be modified by the available deposition parameters such as plasma excitation power, substrate location and temperature, target bias, gas pressure and flow rates. This work not only presents an innovative method for the deposition of tungsten nitride and carbon-based functional films with tunable structure, composition and properties but also reveals the dynamic process of film preparation both by HWP physical sputtering and chemical vapor deposition.

Key words: helicon plasma, physical sputtering

deposition, chemical vapor deposition, functional films.

### References

- [1] Tianyuan Huang, Chenggang Jin, Jun Yu, Xuemei Wu and Lanjian Zhuge, High magnetic field helicon plasma discharge for plasma-wall interaction studies, *Sci. China Phys. Mech. Astron.* 59, 645201 (2016)
- [2] Tianyuan Huang, Peiyu Ji, Jianjun Huang, Bin Yu and Xuemei Wu, Sputter deposition of WN<sub>x</sub> thin films by helicon-wave-excited argon plasma with N<sub>2</sub> seeding, *Surface & Coatings Technology*, Volume 410, 126941 (2021)
- [3] Peiyu Ji, Jiali Chen, Tianyuan Huang, Lanjian Zhuge and Xuemei Wu, Hydrogen-modulated Ar/CH<sub>4</sub> HWP-CVD for fast preparation of multi-wall carbon nanotube arrays with high specific capacitance, *Diamond Relat. Mater.* 109, 108067 (2020)
- [4] Peiyu Ji, Jiali Chen, Tianyuan Huang, Chenggang Jin, Lanjian Zhuge and Xuemei Wu, Fast preparation of vertical graphene nanosheets by helicon wave plasma chemical vapor deposition and its electrochemical performance, *Diamond Relat Mater.* 108, 107958 (2020)

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