

Metal Containing Diamond-Like Carbon Deposition System

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Summary

CAMD/LSU received funds from the Board of Regents' Enhancement Program for modifying and upgrading of a diamond like carbon (DLC) deposition system. This included a magnetron with shield, DC power supply and pulsing unit, mass flow controllers and in-situ thin film deposition monitoring equipment. Two graduate students had worked on the system to understand it and use it to optimize the deposition parameters. One of them did his independent study in which he had used the upgraded thin film deposition system in spring 2011. This new system has a larger chamber than the original chamber, Fig.1, making it a more versatile system handling also larger sized samples for deposition of DLC, metal(s)/ ceramic(s) and/or metal/ceramic containing DLC films.

Improved performance of the system includes a larger process chamber. The old chamber that was 6.5" in height and 12" in diameter shown in Fig. 1a was replaced with the bigger chamber (diameter 12" and height 19") that was available in house, shown in Fig. 1b. Now, instead of 8" flange in the old chamber, Fig. 1a, the new chamber has a 14" flange at the bottom. The main advantage of it is that we can handle larger substrates. This will also give us the larger range of the distance between magnetron and the substrates on which coating(s) will be deposited enabling us to vary the properties of the coatings as required by different applications. Another added advantage of the larger chamber was that in future multiple magnetrons can be installed on this flange to co-deposit more than one metal/ ceramic as a coating by itself or to be incorporated into DLC films.

The whole system has been mounted on a stand, Fig.2. The installed magnetron and the shield inside the chamber can be seen in Fig. 3. The chiller along with deposition chamber and vacuum pump is shown in Fig. 4. Further, new mass flow controllers allow precise control of flow rates. This controller along with the power supply of the chamber and the power supply for magnetron along with its sparc-LE pulsing unit have been mounted on a cabinet placed close by the deposition chamber, are shown in Fig. 5. Fig. 6 presents an image of the working system, which shows the purple color plasma inside the chamber through the glass window in the door.

This upgraded larger deposition chamber is more versatile than the previous installation and can support a wider range of research activities and objectives. Since the installation of the system a limited amount of work had been done on it, based on limited availability of time. Based on this work a talk was given in the 2011 Acta Materialia Gold Medal Symposium [1]. In the reference section we have listed, some of the first users of the system, magnetron sputtering was performed to deposit metals on the samples for the research projects of two students [2,3], and another student is using the DLC based films deposited in the system for his research [4].



Fig.1a: Original DLC Film deposition system

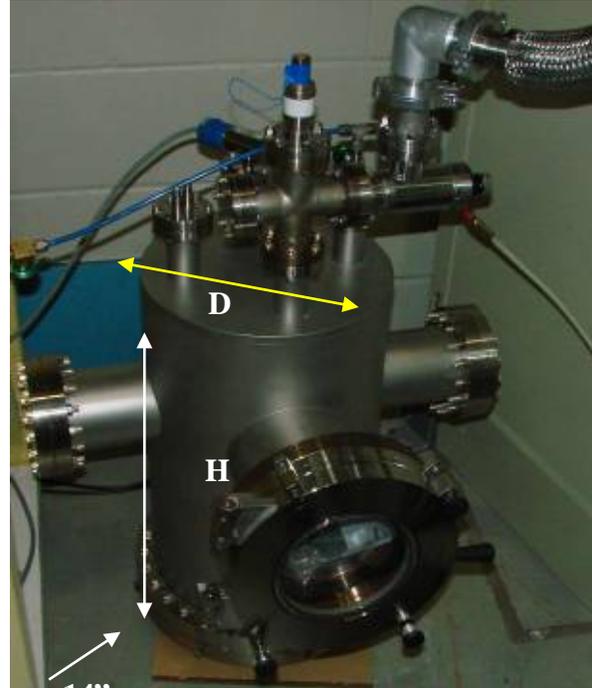


Fig.1b: Modified system

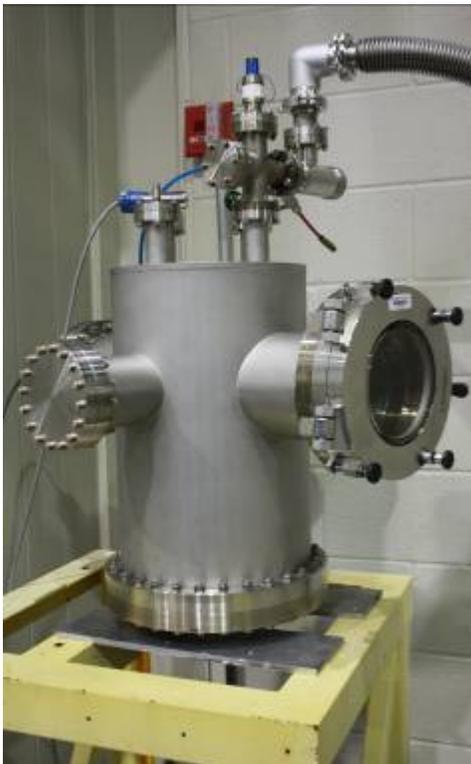


Fig.2: DLC system on the stand

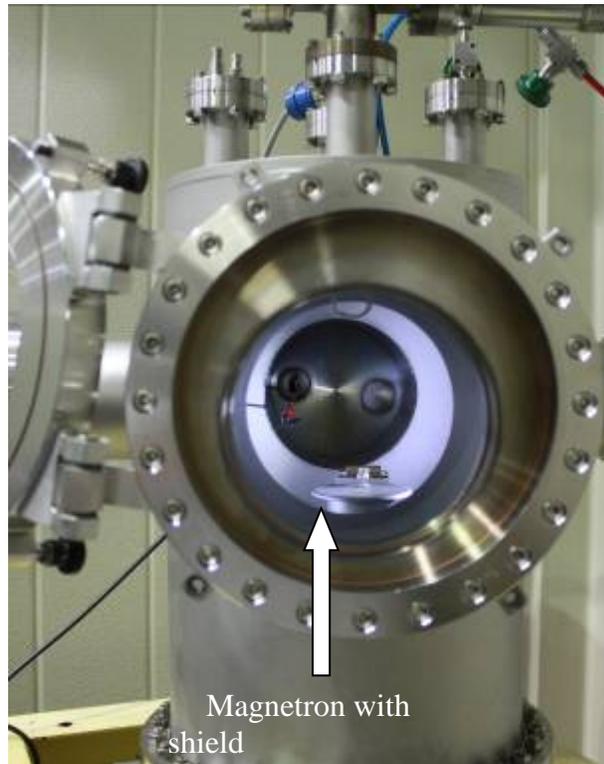


Fig.3: Magnetron installed in chamber

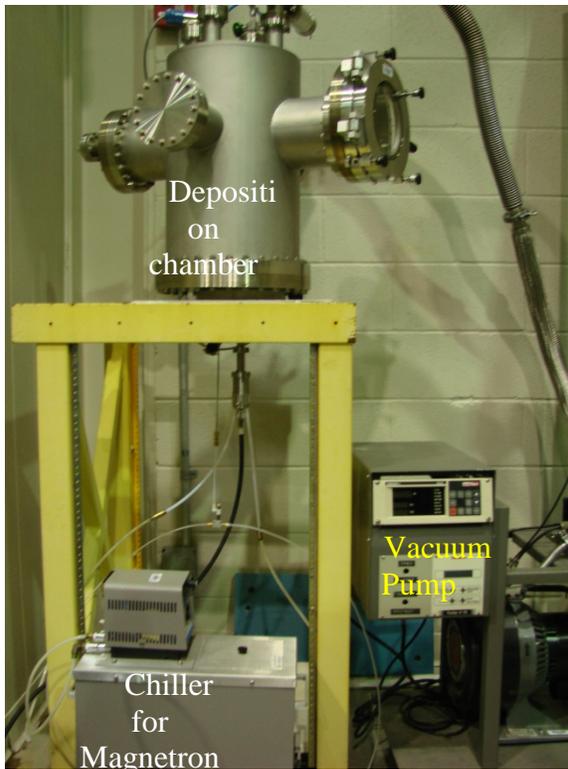


Fig.4: Deposition chamber, water chiller and vacuum pump

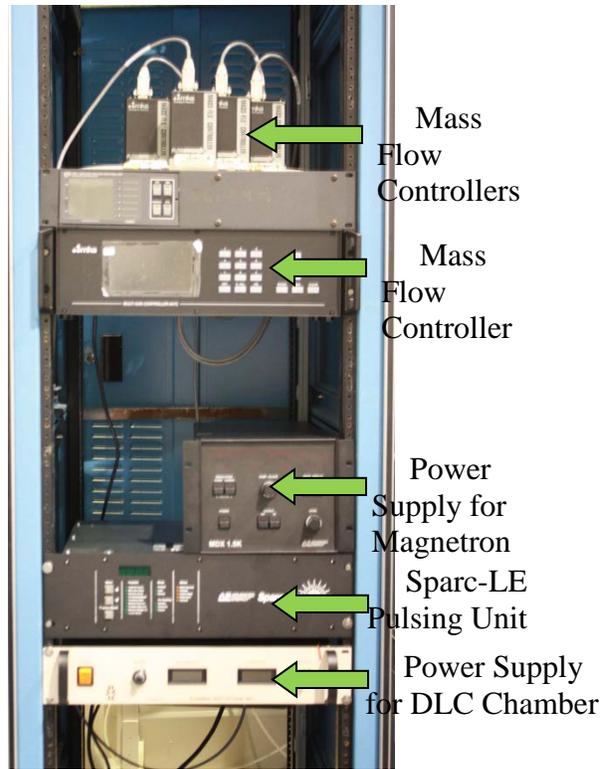


Fig.5: Controls for gases supply and power supply

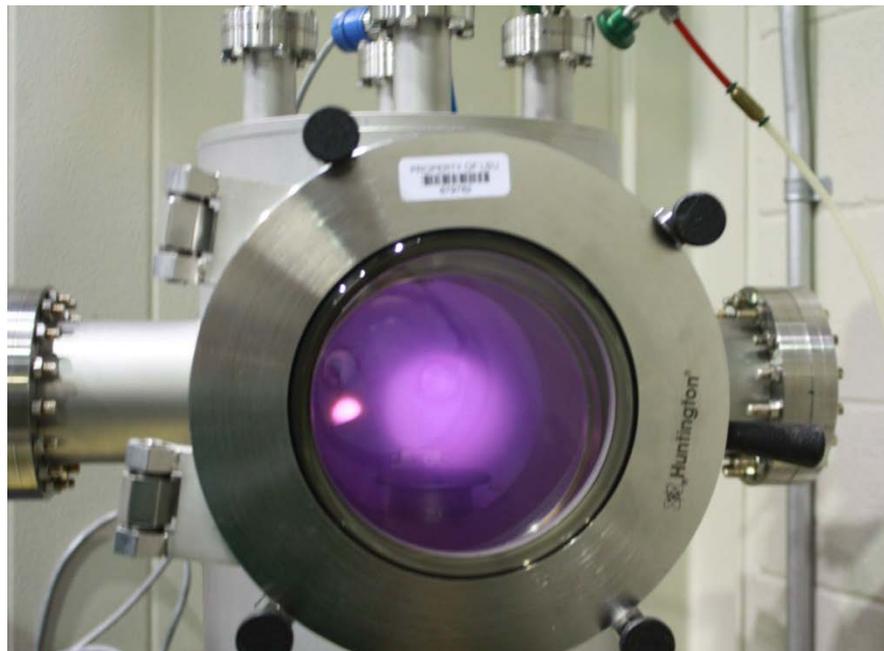


Fig. 6: The chamber with purple plasma seen through the glass window

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References

1. V. Singh and Y.B. Losovyj, *Nanostructured Metal Containing Diamond-Like Carbon Films* in Symposium: International Symposium on Advances in Nanostructured Materials and Applications: The 2011 Acta Materialia Gold Medal Symposium; Materials Science & Technology 2011 Conference and Exhibition, October 16-20, 2011, Columbus, OH, USA
2. Michael D. Vincent a PhD student of Dr Steve Soper, Department of Chemistry, LSU.
3. Rachel Yates an accelerated M.S. student of Dr Marcio de Queiroz, Department of Mechanical Engineering, LSU.
4. Ataollah Mesgarnejad a PhD student of Dr M. Khonsari, Department of Mechanical Engineering, LSU.