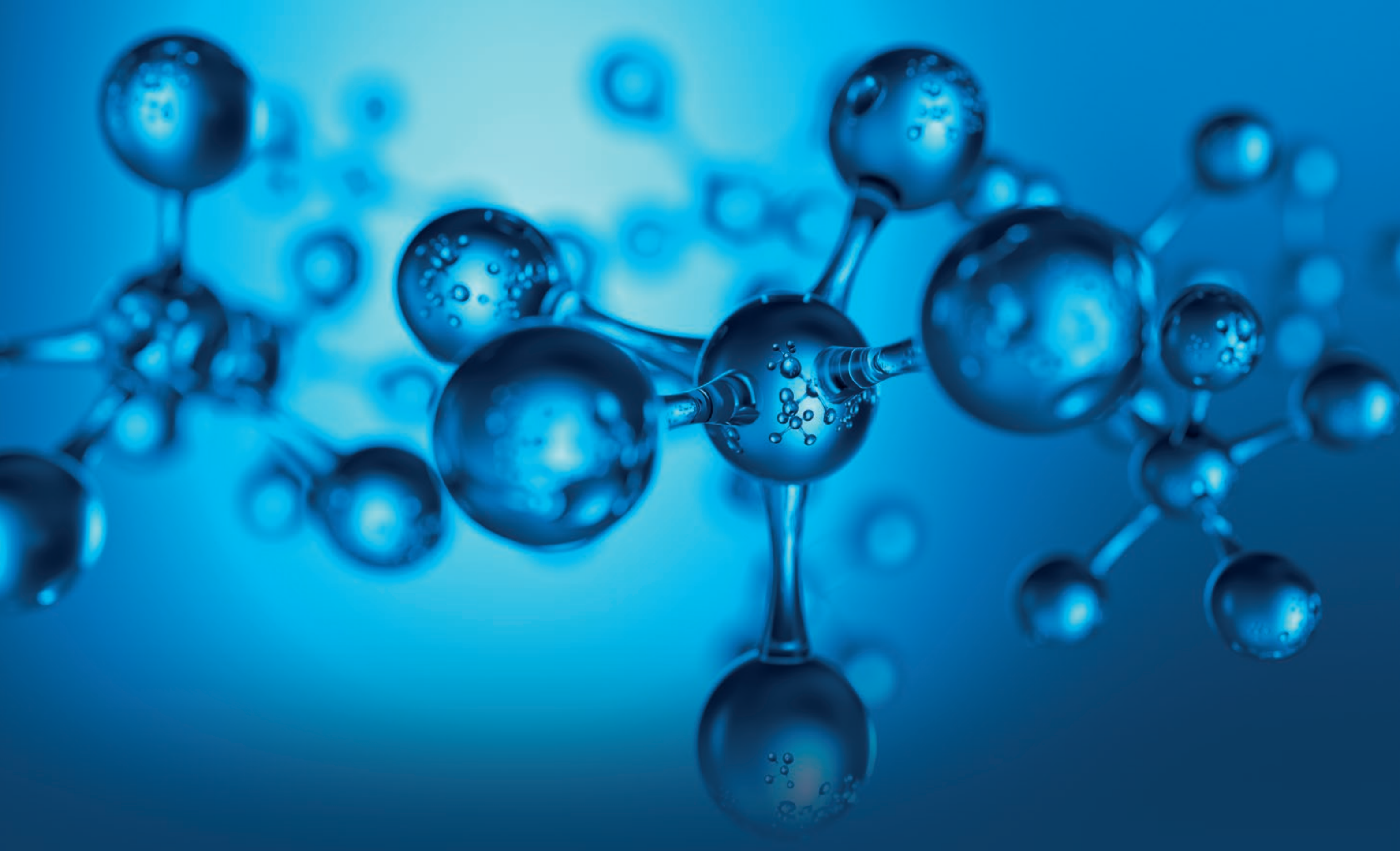


Reducing Cost of Ownership for DLC

Head of Technology BU Batch Systems **Rico Benz** and **Dr. Heiko Plagwitz**, Senior Scientist BU Inline, show how new approaches in the deposition of DLC coatings can save time and money for both custom infrared and mass market consumer applications.

It's already used in a whole range of applications such as in tool coatings but also for corrosion and impact protection in hard disk data storage applications and now increasingly in optical applications. On one hand DLC is the perfect coating for the surface protection of high end hand held devices, and on the other, its index of refraction in the infrared is in the range 1.7 to 1.9 making it a good optical match and a good choice of protection for high index substrates like Si, Ge and ZnS used in infrared optics which have limited durability and get damaged easily.

Typical requirements for the DLC layers required in all these applications vary widely. e.g they could be employed as a thin layer on top of the substrate or AR stack, or in thicker layers as part of the AR stack itself. However, a common request from device manufacturers is for more cost effective production methods than are currently available where the DLC process is usually isolated in a separate step requiring extra equipment, floor space and human handling.

Fig 1.
Set up in
BAK1101

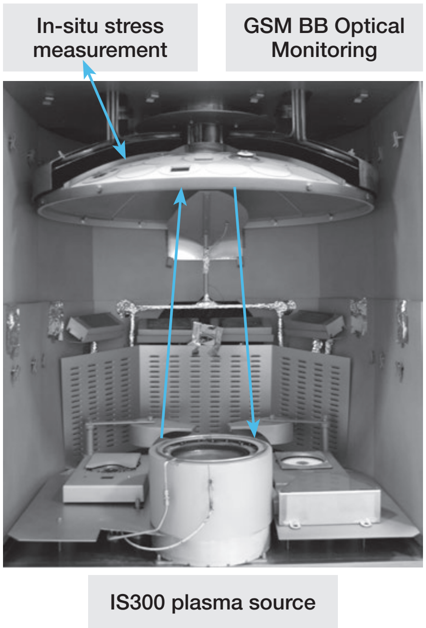
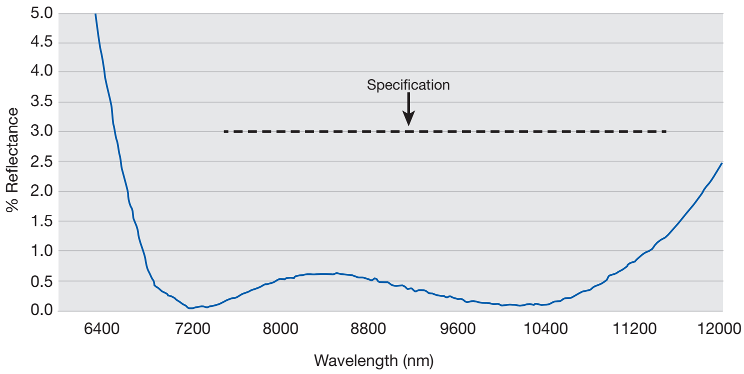


Fig 2.
Optical spectrum for
combined AR+DLC
prepared in BAK1101



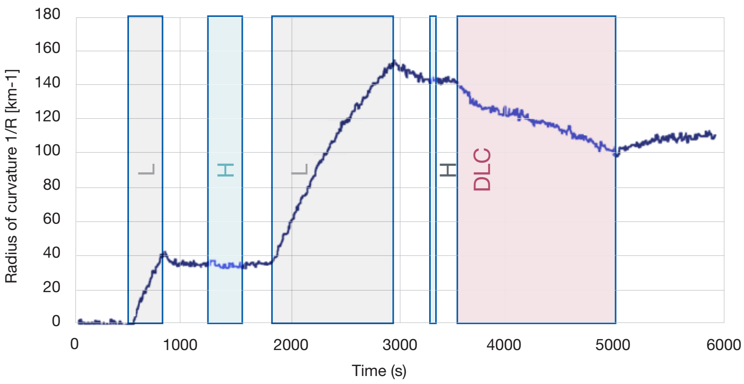


Fig 3. Stress monitoring
during the deposition
cycle

SOLVING CHALLENGES FOR INFRARED OPTICS

Coatings on optics for IR applications at 3-5 or 8-12 microns for applications like thermal detection and night vision are typically made in a two stage process. In a first step the spectral AR coating is prepared by evaporation in a box coater, while in a second independent step a thin DLC protective coating is prepared in a separate system by techniques such as PECVD or magnetron sputter.

In a new approach we have been able to combine PVD of the multispectral coating and PECVD deposition of the DLC coating in the same BAK 1101 box coater deposition system to bring superior film quality without the intermediate vacuum break, reduced handling and ultimately bringing lower production costs. Broadband AR films for IR in the 8-12 micron regions could be prepared using e gun sources in the normal way. An inductively couple plasma source combined with combinations of Methane, Butane and Acetylene process gases could then be used to deposit high quality DLC coatings.

The equipment set up is shown in Figure 1. Optical spectra measurement results for combined AR+DLC are shown in Figure 2. In situ stress measurement during deposition itself (Figure 3) show a compressive stress of around 750 MPa in the DLC. The coatings show good adhesion, spectral performance and satisfy tough tests required for military applications including “wiper tests” (Figure 4).

THE WIPER TEST

Fig 4.

Different hardness and wear tests such as “Nanoindentation” or the “Bayer” are carried out depending on the application of the DLC layer. In the “Windshield Wiper Blade Test” a container is filled with a sand and water mixture. A wiper blade rotates with defined force on a test sample according to standards defined by RSRE (Royal Signals and Radar Establishment) test results are judged by eye and classified.