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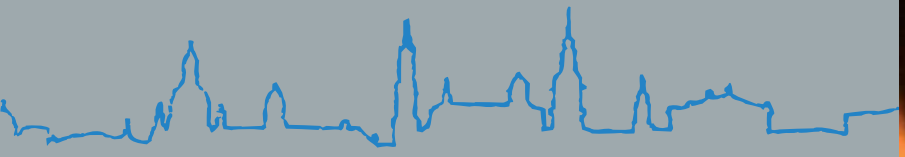
IWS

FRAUNHOFER INSTITUTE FOR MATERIAL AND BEAM TECHNOLOGY IWS

BUSINESS FIELD – PVD VACUUM COATING TECHNOLOGY



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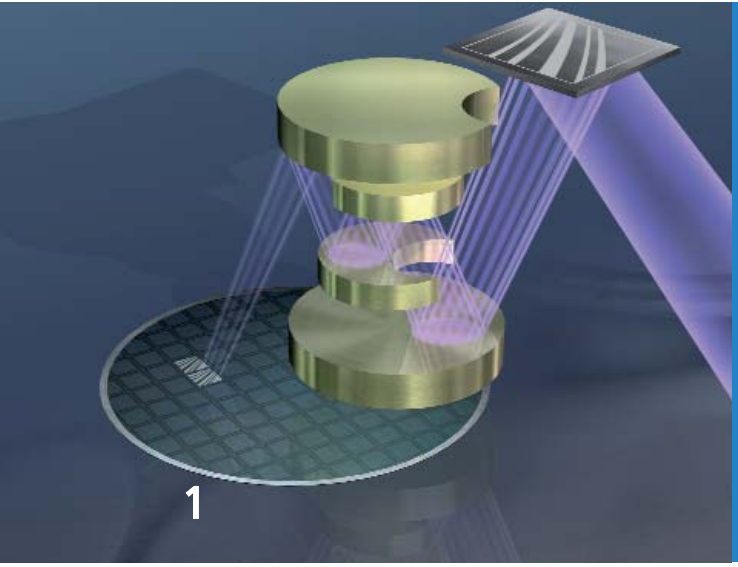
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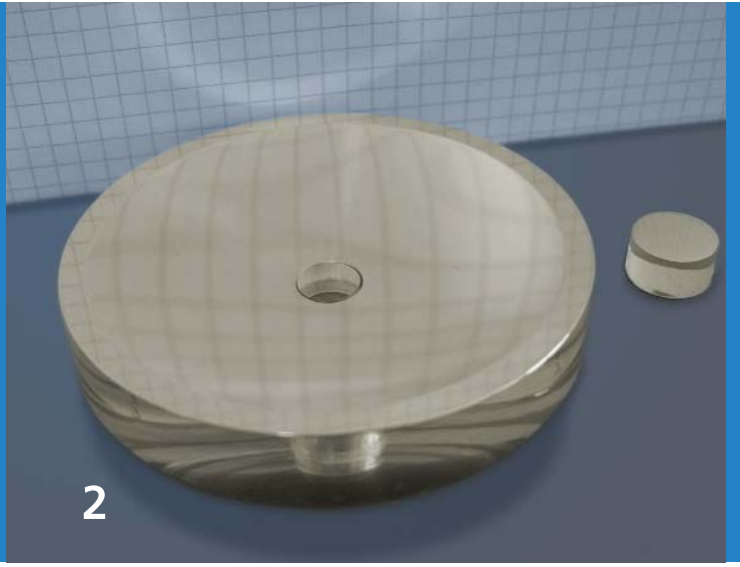
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NEW COATING SYSTEMS TO DEVELOP NEW APPLICATION FIELDS

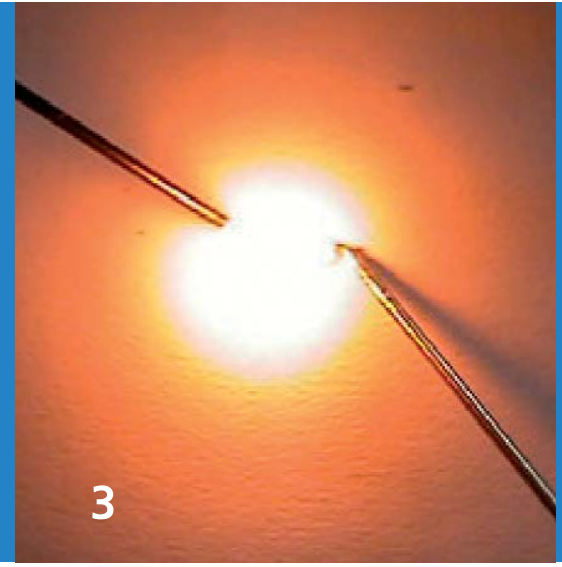
Within the business field PVD vacuum coating technology, the Fraunhofer IWS develops and researches processes to fabricate various coatings and coating systems, which are based on physical deposition processes. The activities are complemented by the development of corresponding process and system technologies for industrial high volume manufacturing applications.

Scientific basis

- substantial know-how in the area of PVD coating processes
- long-term experience in the field of synthesizing hydrogen-free amorphous carbon coatings
- deposition of high precision multilayer systems that are used for example on optical components for EUV and lithography and X-ray applications
- development of customized coating modules and system technology

Trend

The hydrogen-free amorphous ta-C carbon coatings (Diamor) have a substantial application potential as wear protective and friction reducing coatings. Recently the research focus has expanded to functionalized properties of these coatings outside of tribology. By using simulation techniques and an appropriate design it is possible to synthesize customized coating systems that are optimized for specific applications. By simultaneously developing the corresponding system technology the institute ensures the commercial availability of the coating technology.



OUR COMPETENCES

Optimized application of physical deposition processes

The core competence within the business field PVD vacuum coating technology is a broad know-how of physical coating technologies. The spectrum of processes includes the fabrication of ultra precise multilayer stacks using magnetron and ion beam sputtering techniques, various processes to deposit amorphous carbon coatings and high rate deposition techniques.

For example, in the area of EUV coatings the institute demonstrated very early a process that generated coatings of highest reflectivity, which is a central parameter for the design of future EUV wafer steppers. Other technical requirements that were met by IWS technology include the reduction of intrinsic stresses, the synthesis of steep gradient layers and the reproducibility of individual layers with thicknesses in the range of a few picometers. In addition our engineers and scientists are working on the development of nanometer reactive multilayers and their applications.

A central activity is also the deposition of hydrogen-free amorphous carbon coatings (ta-C). Compared to conventional DLC coatings the institute's ta-C films have a substantially higher hardness and show a significantly improved low friction performance in particular under unlubricated (dry) friction conditions.

In addition to coating deposition know-how the IWS developed a substantial pool of advanced process technologies. These include, for example, pulsed high current vacuum arc processes, various processes for magnetic or electric plasma filtering to reduce particles during the deposition and a vacuum arc based process to produce single wall carbon nanotubes (SWCNT). The institute is also known for its non-destructive laser acoustic measurement system to test thin films.

1 *Schematics of a semiconductor lithography process using EUV radiation*
2 *Coated mirror pair (Schwarzschild lens)*
3 *Electric ignition of a reactive multilayer*
4 *Integrated laser arc module in a coating machine at the Fraunhofer IWS*
5 *Diamor coated gear flanks*

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HIGHLIGHTS

Fraunhofer IWS researchers demonstrated the worldwide highest reflectivity of multilayer thin film coatings. These data are a key parameter for the upcoming EUV lithography. Furthermore, the scientists of our institute are in a leading position with respect to the development of other important parameters, such as low intrinsic stresses or steep thickness gradients, parameters which are essential in the field of EUV lithography.

In the area of amorphous carbon coatings the institute further improved the laser arc based process and system technologies. It is now possible to reproducibly deposit strongly adhering ta-C coatings of up to several tens of micrometers. Simultaneously the associated system technology was readied for commercial applications. A decisive milestone to commercialize ta-C coatings was achieved by installing the first industrial coating machine for high volume production.

The scientists of the Fraunhofer Center for Surface and Laser Processing CSLP, USA und of the Fraunhofer IWS, Dresden, jointly developed and commercialized the laser acoustic tester LAwave®. They were awarded with the renowned R&D 100 Award for this excellent tool. In a nondestructive way, the laser acoustic measuring device LAwave® determines characteristics of thin films and was thus highly appreciated as a precious contribution in the field of applied nanotechnology.