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Adam H Khan

AKHAN Semiconductor, USA

Multilayer nanocrystalline diamond for optical sensing and electronics display application

Diamond is a well-known material that commands many excellent characteristics including great hardness, high thermal conductivity, high-optical transparency, and excellent chemical stability. In this work, we study the practical and economical usage of Nanocyrstalline Diamond (NCD) as a first surface in an anti-reflective coating upon a traditional substrate. Using measured index of refraction and extinction coefficient values, multi-layer coating solutions for different spectral regions such as the visible or infrared wavelengths were developed using OpenFilters optical design software. The simulation results from OpenFilters software indicate comparable transmissivity and reflectivity performance to known solutions while providing enhanced mechanical properties such as improved breakage and scratch performance and resistance to impact from airborne particles. Pioneering work on low temperature, high quality diamond deposition methods by AKHAN Semiconductor Inc. has opened the doors for the use of diamond in a wide variety of optical applications. It is shown that Nanocrystalline Diamond (NCD) coatings with grain size of 10-100 nm can significantly enhance the breakage, scratch performance and hydrophobicity of glass displays and lenses. With Complementary Metal Oxide Semiconductor (CMOS) device integration now possible utilizing nanocrystalline diamond on a wide variety of optical substrates, new opportunities are now possible for the next generation of optical sensing technologies.

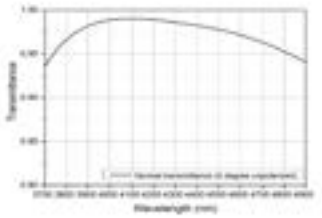

Figure 1: Transmission spectra for nanocrystalline diamond based infrared anti-reflective coating

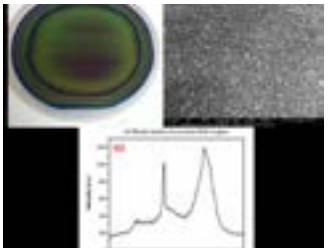

Figure 2: (a) 100mm thin film nanocrystalline diamond on oxide on silicon wafer (b) Scanning Electron Microsopy image of the NCD surface (c) UV Raman Spectra plot for the NCD film

Biography

Adam Khan is Founder and CEO of AKHAN Semiconductor. He has authored several patents and technical publications, and is also a frequent speaker on Diamond Semiconductor and Clean Technology. As a result of his award-winning research, which he began as an Electrical Engineering student at age 19, he is co-inventor of the Miraj Diamond™ Platform. He has served as a Speaker and Expert Witness to a variety of Federal bodies, including the US House Space, Science and Technology Committee and the US Department of Energy. Most recently, his work was recognized and individually honored by the United States Congress in the 114th Congressional Records and Proceedings. He earned his BS in Electrical Engineering and Physics from the University of Illinois Chicago, before pursuing graduate research at Stanford University. He has been everything from a Forbes 30 under 30 honoree, to a CleanTech Open Midwest Innovation Summit winner

akhan@akhansemi.com