

Advances in Optical Polishing

Floyd McClung floydm@cvnanotech.com *CV Nanotechnology Inc.* CMP User Group Meeting May 16, 2012

V Improve Optical Materials Performance *CV Nanotechnology Inc.*



UV - Fused Silica, Fluorides (CaF₂, MgF₂, BaF₂), Sapphire IR - ZnSe, ZnS, Ge, Si, AlON, Spinel, GaAs, Sapphire Visible - Many glass types (e.g. BK7), Sapphire

Goal – decrease scratches and surface flaws that can be absorption and/or scatter points for light. Too much absorption can actually alter a substrate's chemical properties, rendering it useless and scattering can result in energy loss within the optical system, reducing the efficiency.

V Optical Polishing Process http://www.youtube.com/watch?v=caIE2YX-Peg

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Optical Polishing Process http://www.youtube.com/watch?v=9eI0jnfrbu0

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MRF[®] Technology

CNC Polishing

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- Particle Processing
 - Typical polishing abrasives
 - ceria, alumina, silica, zirconia, diamond
 - Modify particle size, shape, phase, morphology







Fused

Calcined

Precipitated

Alumina particles by different processes

Alumina Particle Modification

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Surface charge and surface coating can be modified

Advances in Particle Processing

- Additional improvements in processing, filtering, etc.



Advances in Slurry Chemistry CV Nanotechnology Inc.

Improved slurry chemistry modifies the substrate surface and/or particle to enhance removal rate, surface finish, cleanability, etc.



V Improve Surface Finish *CV Nanotechnology Inc.*

Goal \leq 0.1 nm RA surface finish



Conclusions



- Similar to semicon CMP, advanced abrasives and chemistry can enable better performing optics
 - In addition, process time can be improved with advanced slurries
 - However, most optical fabrication facilities are not equipped to handle hazardous materials or multiple component slurries
 - Additional work continues on low or zero rare earth containing slurries