

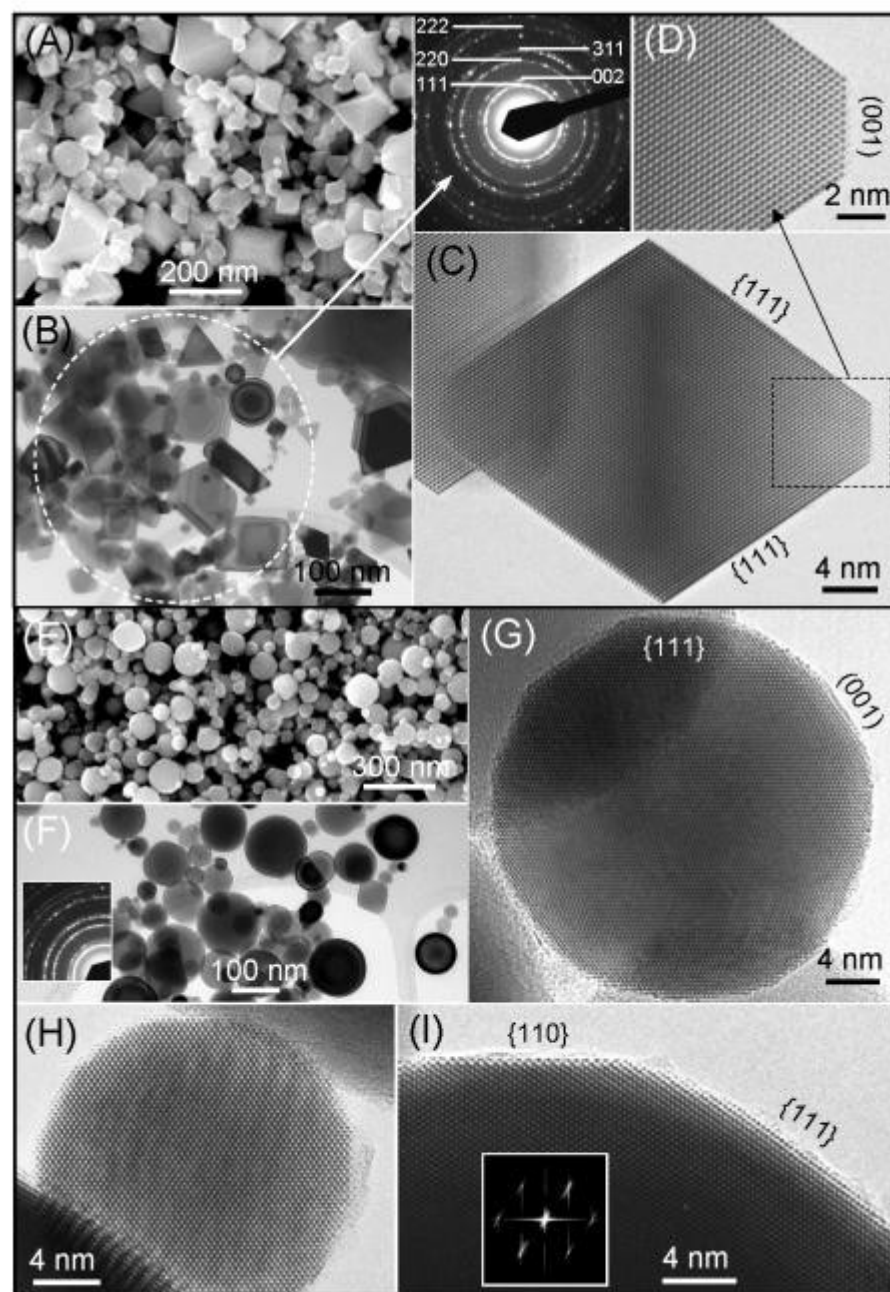


Fig. 1

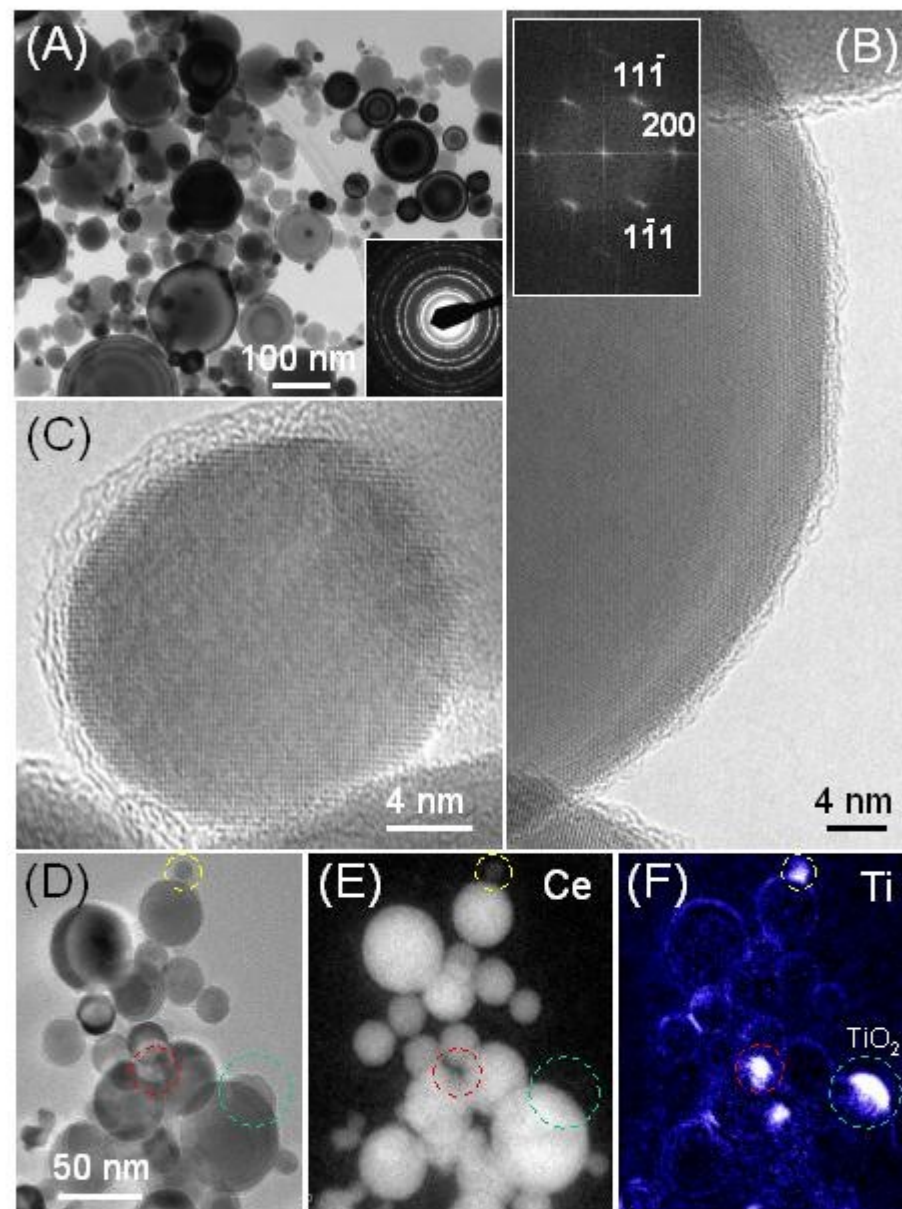


Fig. 2

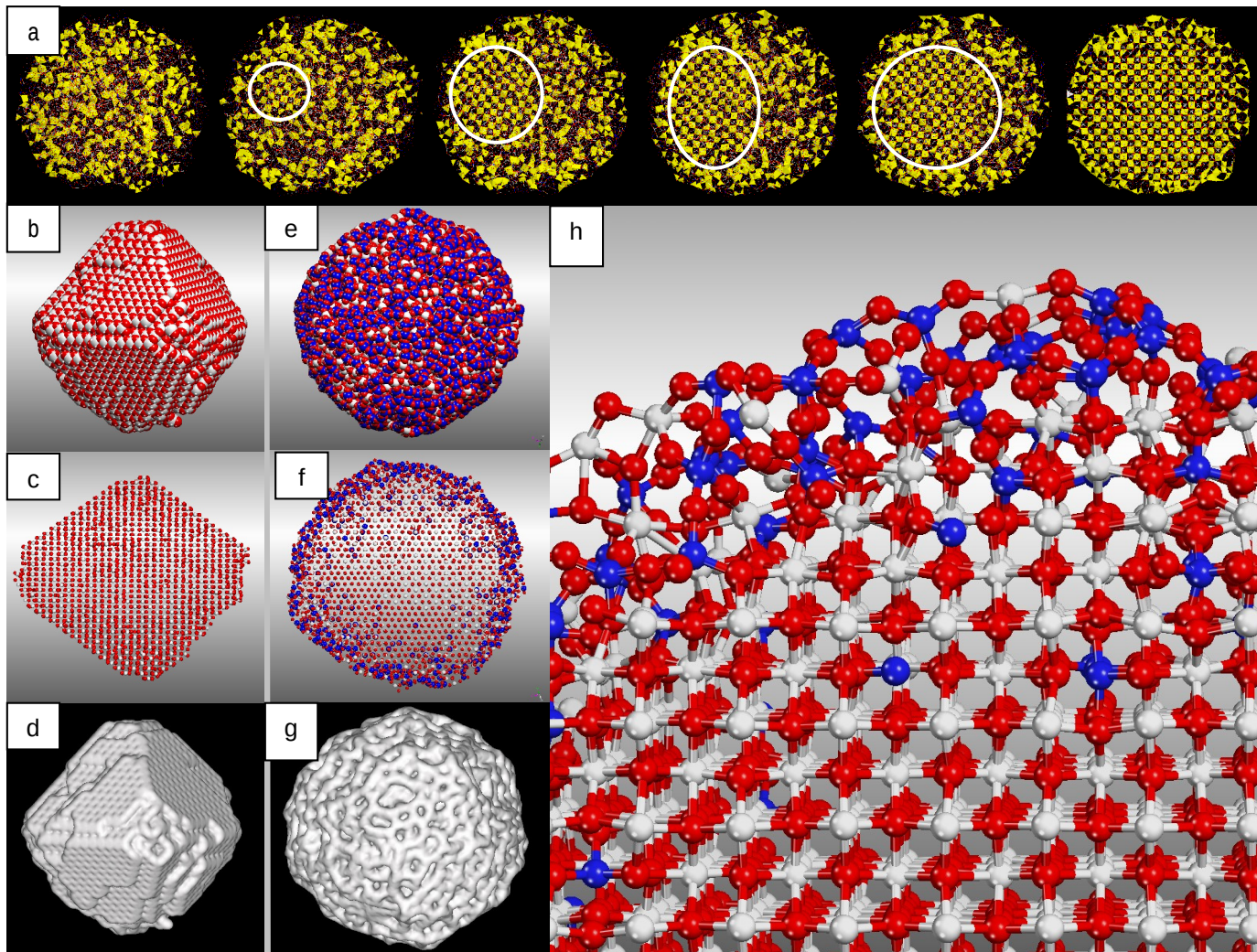


Fig.3

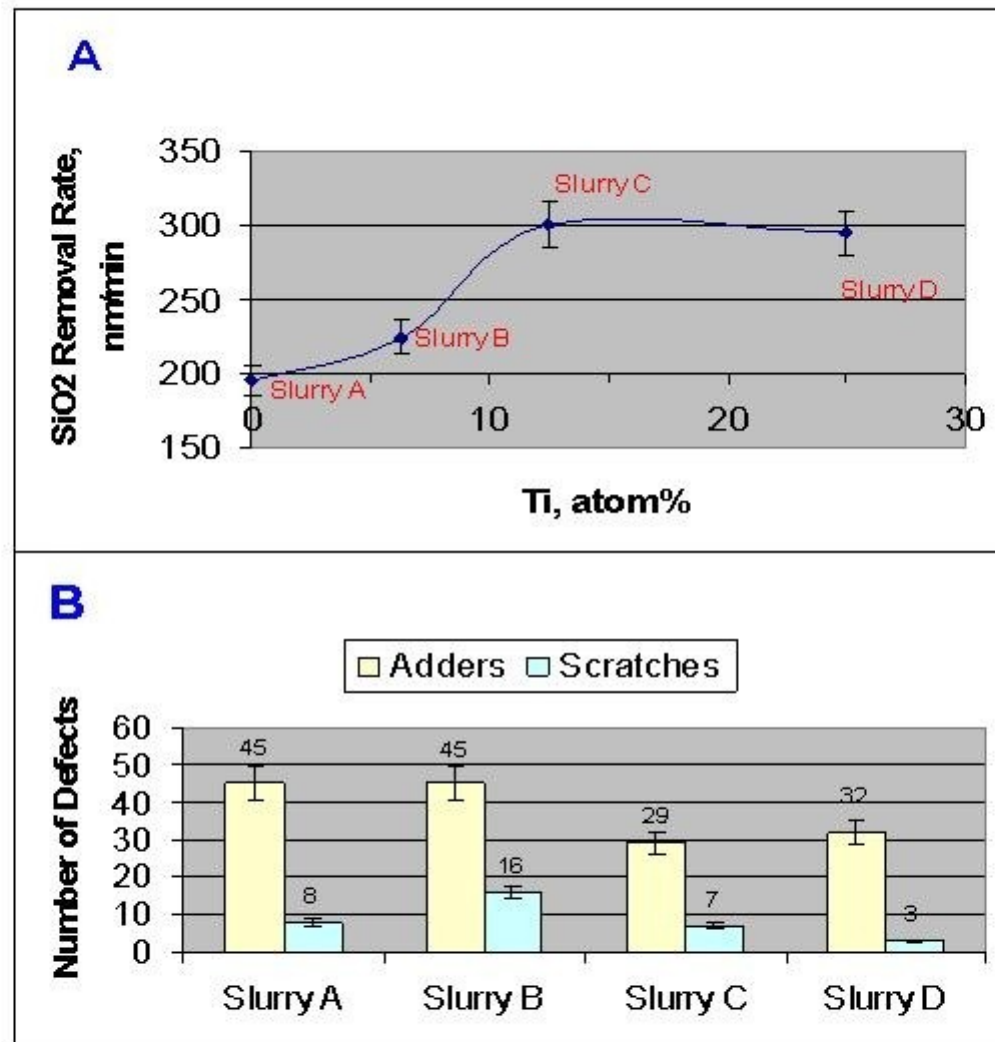


Fig.4

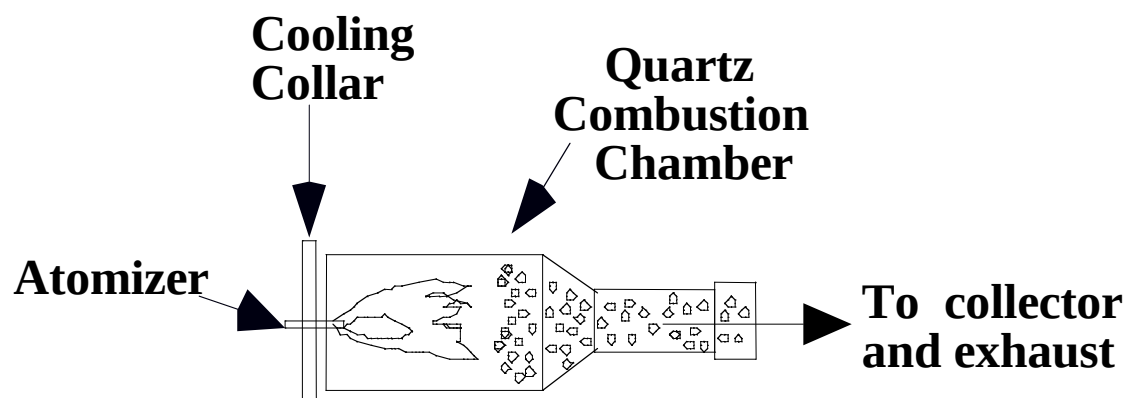
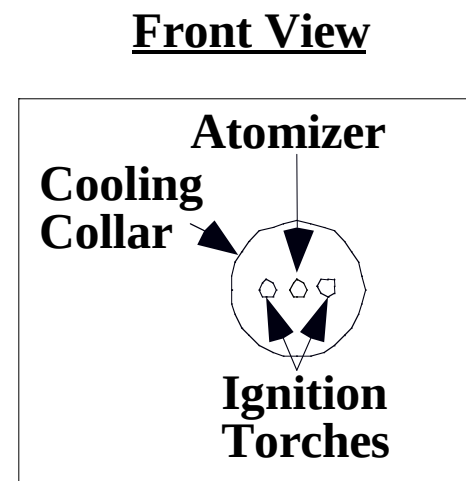


Figure S1: Schematic of a L-FSP apparatus in use at Nanocerox

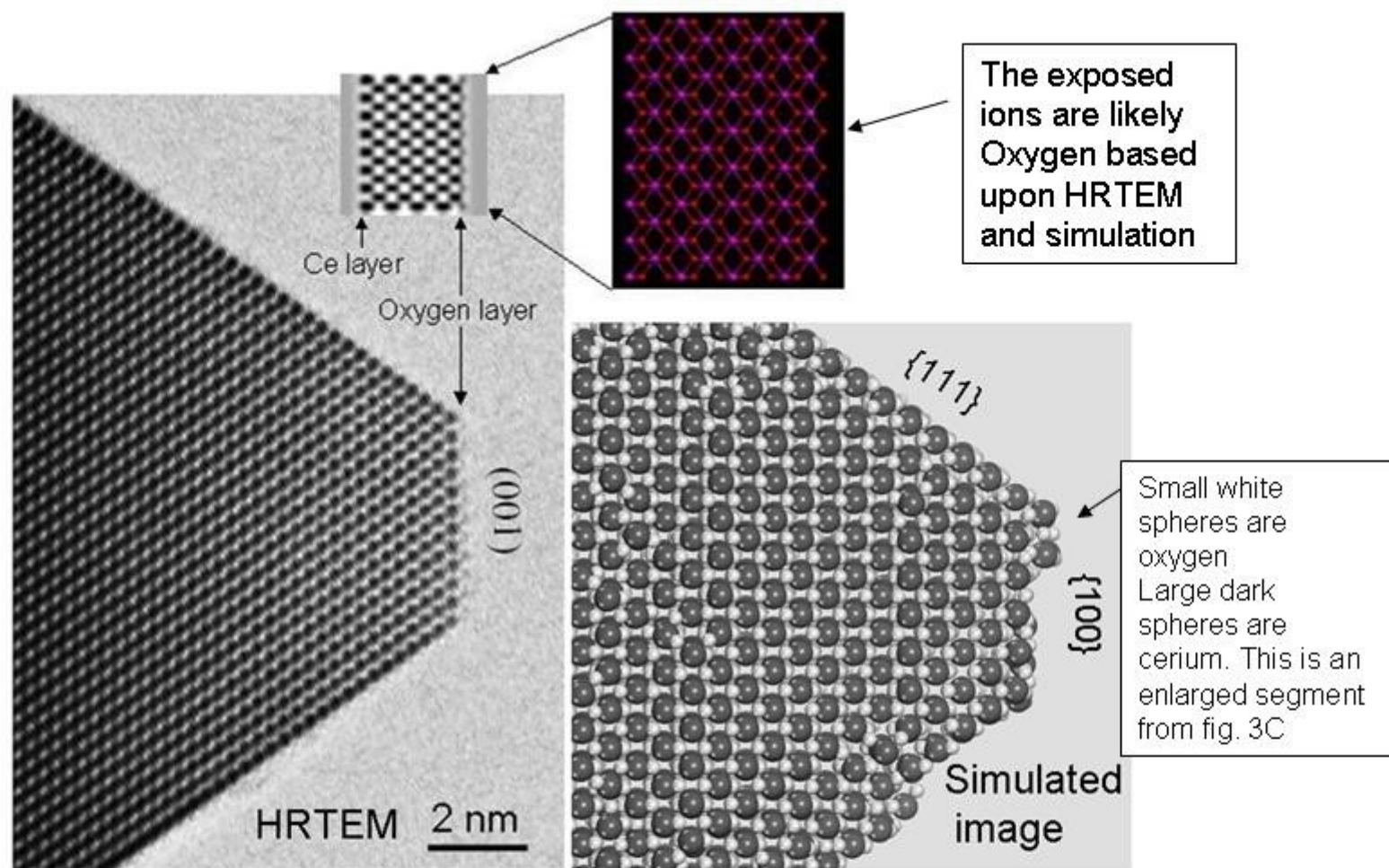


Fig. S2. High-resolution TEM image of the as-synthesized ceria Particle without Ti doping, showing octohedral shape. The simulated image at the right-hand indicates that the Surface is likely to be terminated with oxygen

Fig. S2

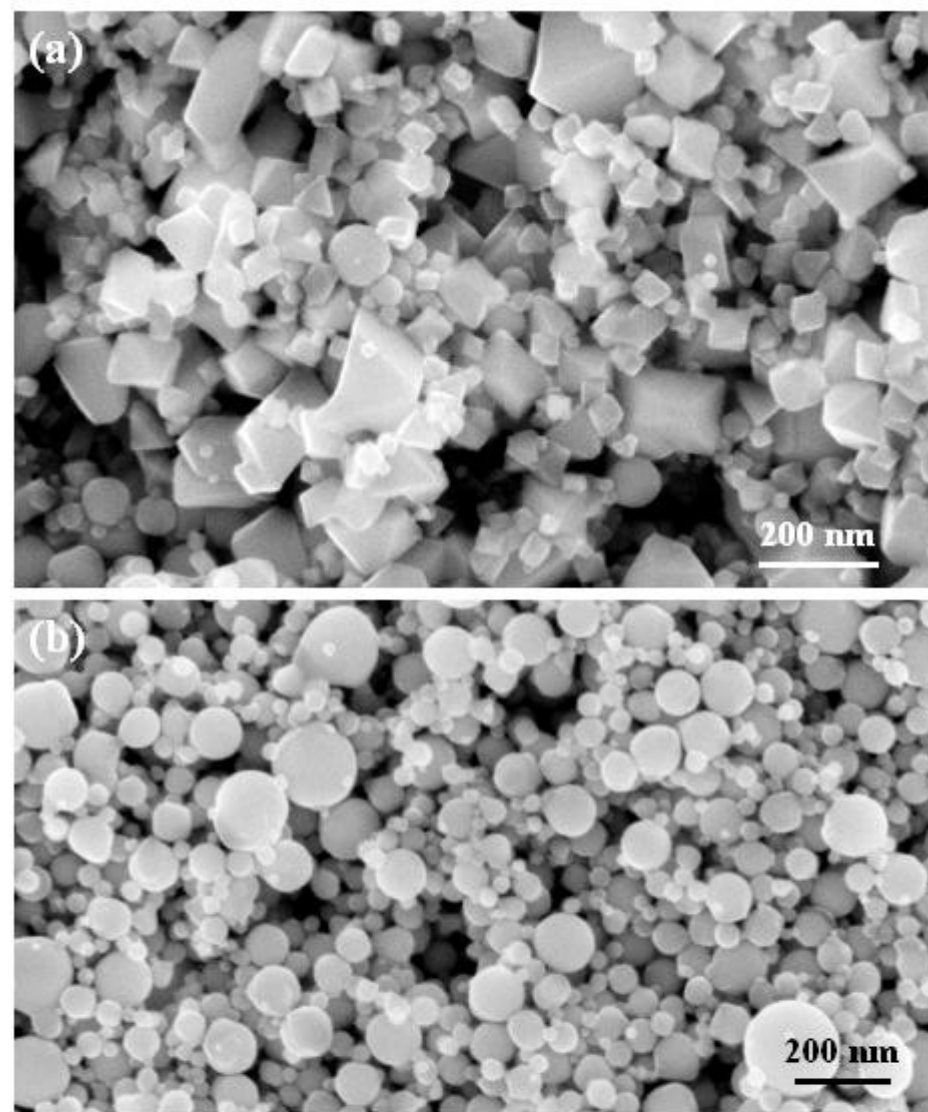


Fig. S3: SEM images of the as-synthesized ceria particle (a) without Ti doping and (b) with 6 at. % Ti doping, showing a drastic difference in particle shape.

Fig. S3

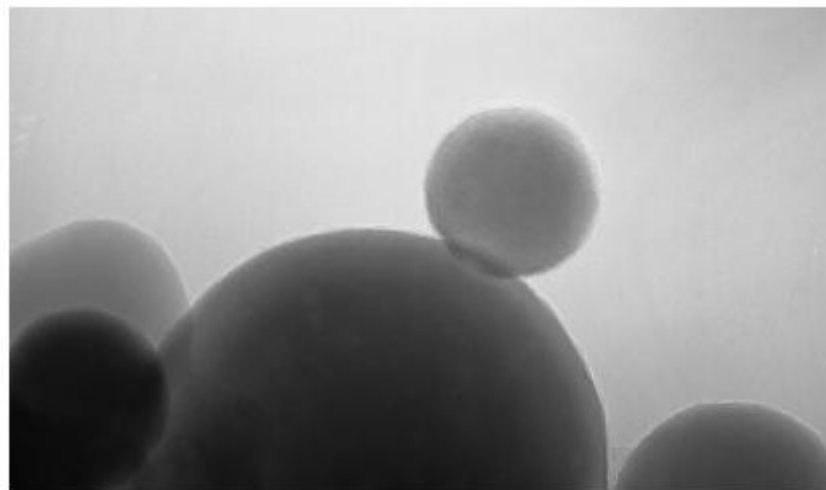


Fig.S4

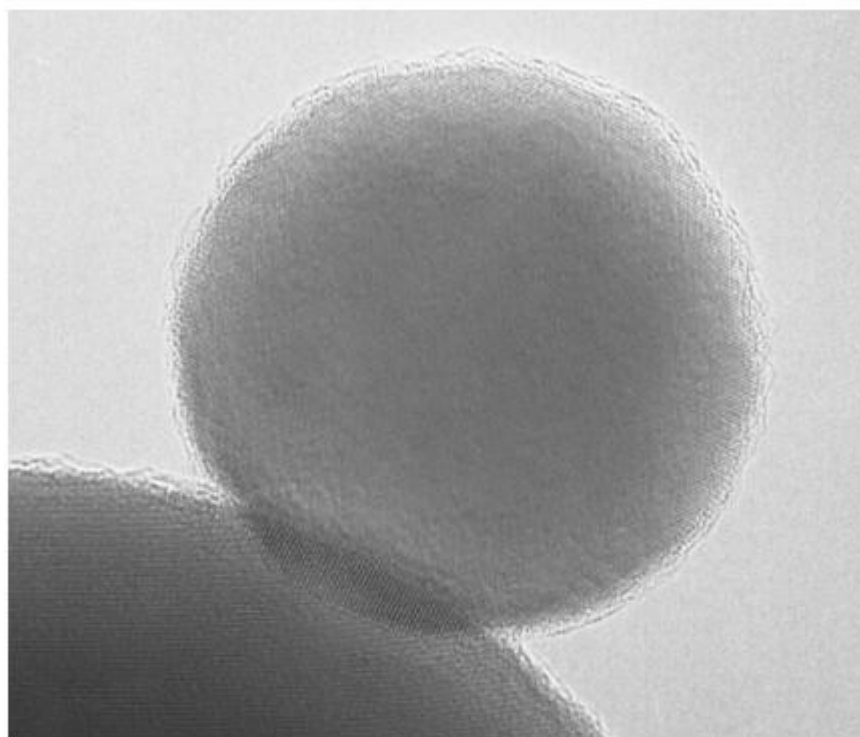


Fig. S4: TEM image of Ti doped ceria single-crystal nanoparticles with perfect spherical shape.

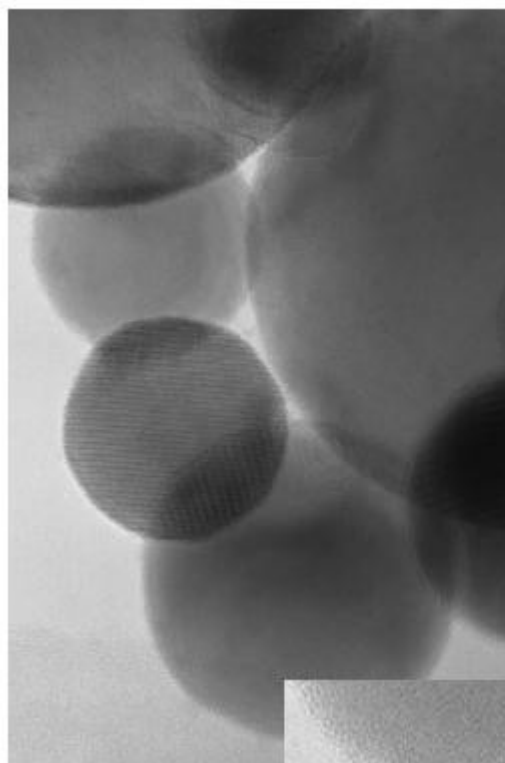
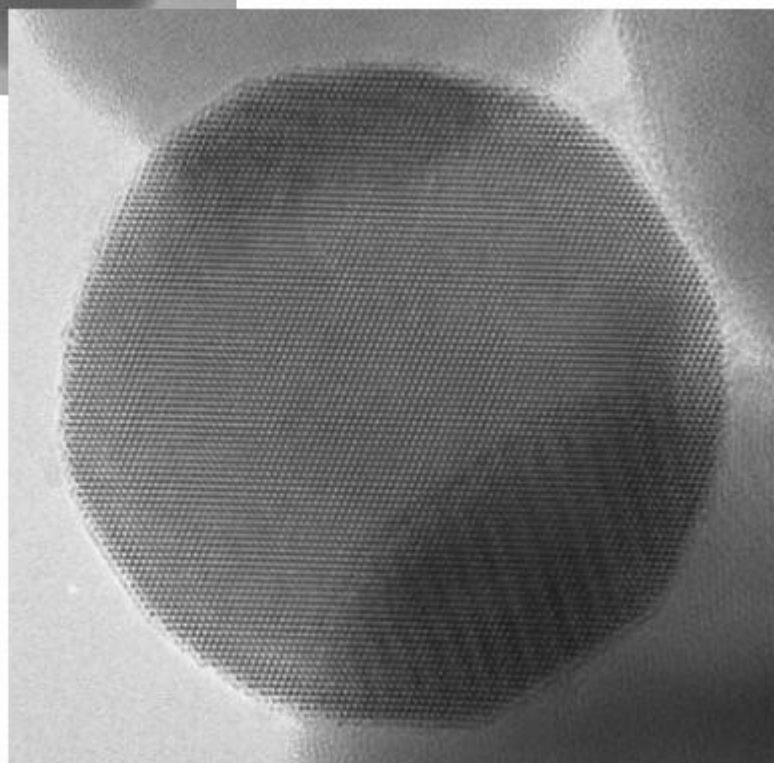


Fig. S5: TEM image of Ti doped ceria single-crystal nanoparticles with perfect spherical shape.

Fig.S5



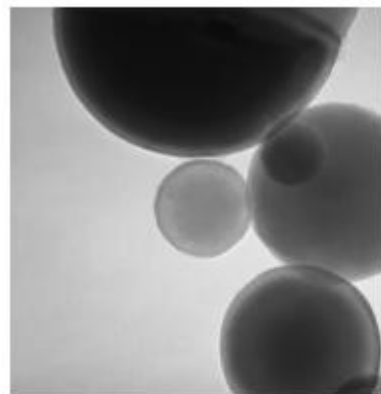


Fig. S6: TEM image of Ti doped ceria single-crystal nanoparticles with perfect spherical shape.

Fig.S6

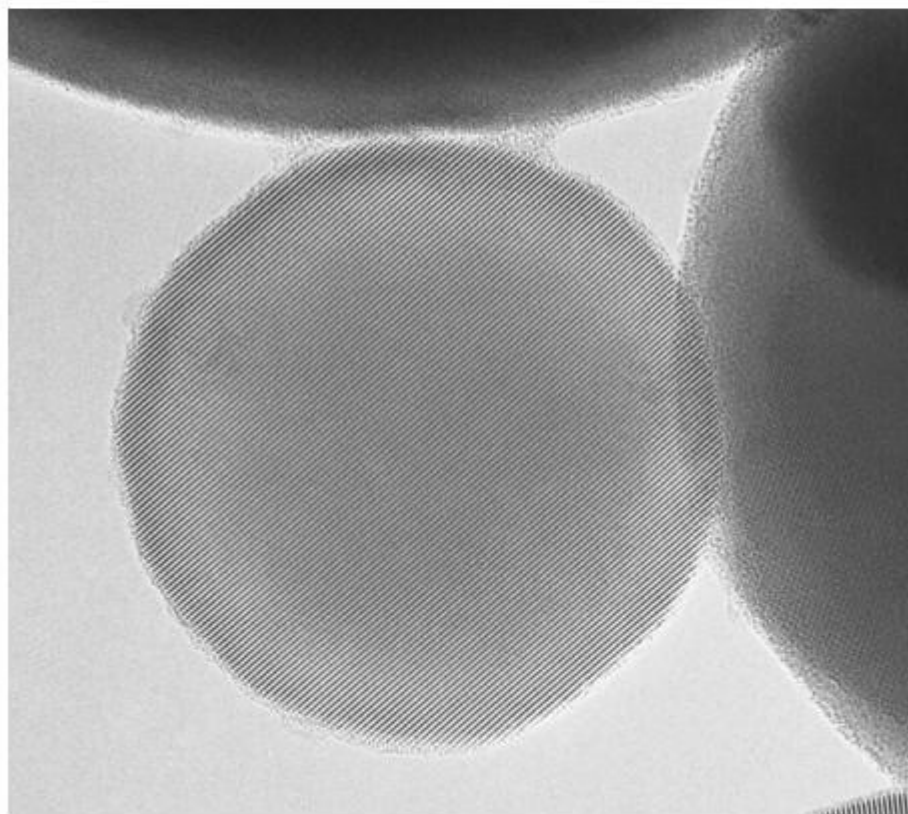


Fig.S7

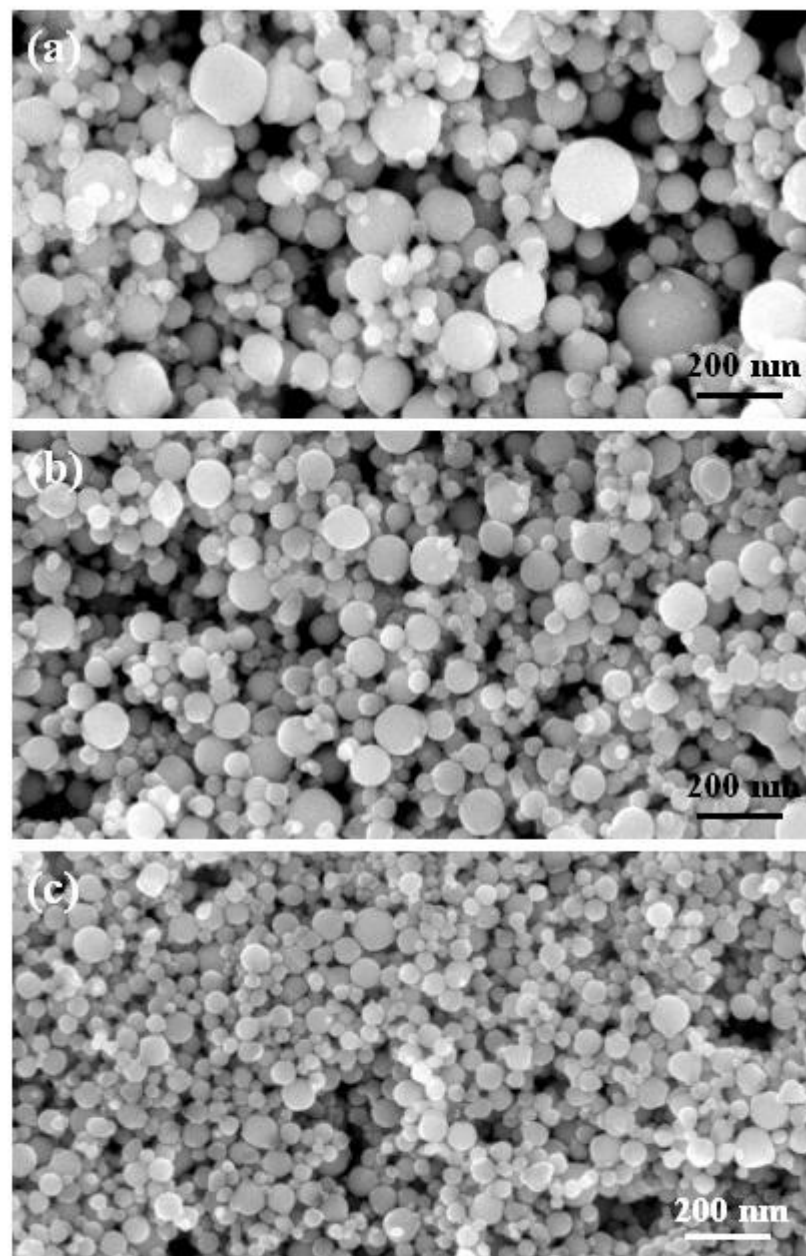


Fig. S7: Centrifugal separation of ceria nanoparticles of different sizes. (a) As-synthesized nanoparticles. (b) After one round of centrifugal separation, and (c) after 5 rounds of centrifugal separation.

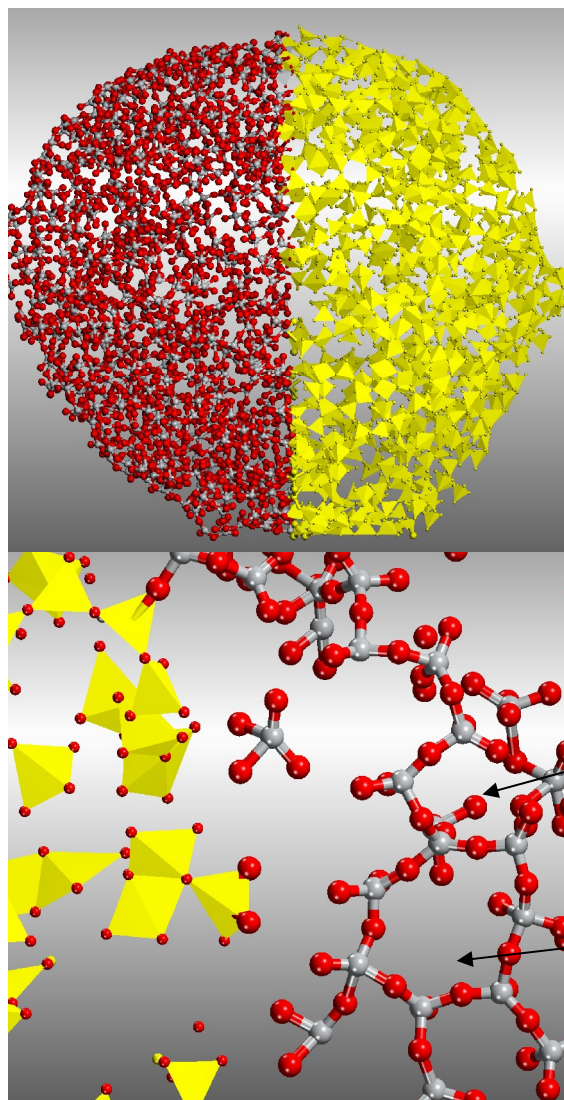


Fig. S8
Dynamic Simulation
of the TiO₂ amorphous
Shell showing short range
Of order, but amorphous
Nature with 5- and 7-
Member rings

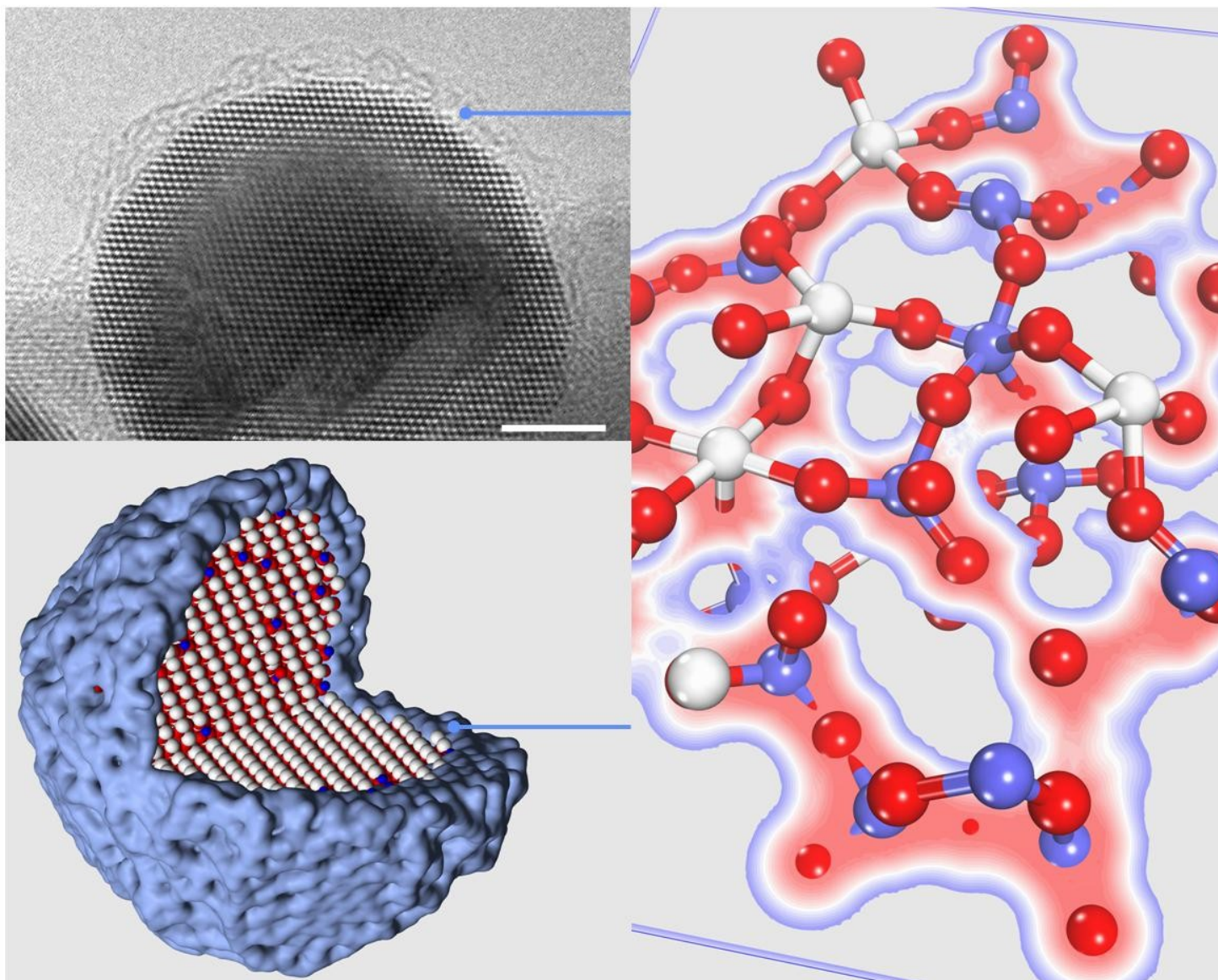


Fig S9. Up left: TEM image of a Ti-doped Ceria sphere and single-crystalline nanoparticle
Lower-left: Model of a Ti-doped Ceria sphere and single-crystalline nanoparticle
Right: Molecular model of the amorphous shell of TiO₂ on the nanoparticle

Table S1. CMP Slurry Compositions and Characteristics

	Slurry A	Slurry B	Slurry C	Slurry D
CeO ₂	1.0 wt%			
Ce _{0.94} Ti _{0.06} O ₂		1.0 wt%		
Ce _{0.88} Ti _{0.12} O ₂			1.0 wt%	
Ce _{0.75} Ti _{0.25} O ₂				1.0 wt%
Proline	1.0 wt%	1.0 wt%	1.0 wt%	1.0 wt%
Water,	98 wt%	98 wt%	98 wt%	98 wt%
pH	4.01	3.87	3.86	3.99
Size, D ₀₅ , μ	0.669	0.584	0.766	1.005
Size, D _{median} , μ	0.153	0.136	0.139	0.175
SiO ₂ , Removal Rate, nm/min	195	224	300	295
Defect: Total	45	45	32	35
Defect: Scratch	8	16	7	3
Defect: Adders	45	45	29	32

The SiO₂ film layer for CMP testing was a 1000 nm thermal oxide film on a silicon wafer. The wafers were polished using a Strasbaugh 6EC polisher, a Rodel IC1000 pad with Suba IV backing at a down pressure of 3.2 psi, and a table rotation speed of 60 rpm, and slurry flow rate of 150 ml/min. The defect study was performed on patterned silica wafers using a two-step process. The defects was examined with a SEM defect detector. For the polishing, the slurry mixture was adjusted to pH 4 using nitric acid. The slurry was then subjected to high shear mixing for 30 minutes and is read for CMP testing.



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Converting ceria polyhedral nanoparticles into single-crystal nanospheres

Feng, Xiangdong; Sayle, Dean C.; Wang, Zhong Lin ; Paras, M. Sharon; Santora, Brian ...

2008-05-27T14:14:25Z

American Association for the Advancement of Science (AAAS)

<http://hdl.handle.net/1826/2582>

Feng X, Sayle DC, Wang ZL, et al. (2006) Converting ceria polyhedral nanoparticles into single-crystal nanospheres. Science, Volume 312, Issue 5779, June 2006, pp. 1504-1508