Supplementary Information for

Hyperdoped Si nanocrystals embedded in silica for infrared plasmonics

Meiling Zhang[a], Jean-Marie Poumirol[a], Nicolas Chery[a], Hervé Rinnert[b], Alaa E. Giba[b,c], Rémi Demoulin[d], Etienne Talbot[d], Fuccio Cristiano[e], Teresa Hungria[f], Vincent Paillard[a], Fabrice Gourbilleau[g] and Caroline Bonafos[a*]

[a] CEMES-CNRS, Université de Toulouse, CNRS, 31055 Toulouse, France

[b] Université de Lorraine CNRS, IJL, Nancy, France

[c]National Institute of Laser Enhanced Sciences, Cairo University, Giza 12613, Egypt

[d] Normandie Univ, UNIROUEN, INSA Rouen, CNRS, Groupe de Physique des Matériaux, 76000 Rouen, France

[e] LAAS-CNRS, Université de Toulouse, CNRS, 31031 Toulouse, France

[f] Centre de Microcaractérisation Raimond Castaing (UAR 3623), 31400 Toulouse, France

[g] CIMAP, Normandie Univ, ENSICAEN, UNICAEN, CEA, CNRS, 6 Boulevard Maréchal Juin, 14050, Caen Cedex 4, France

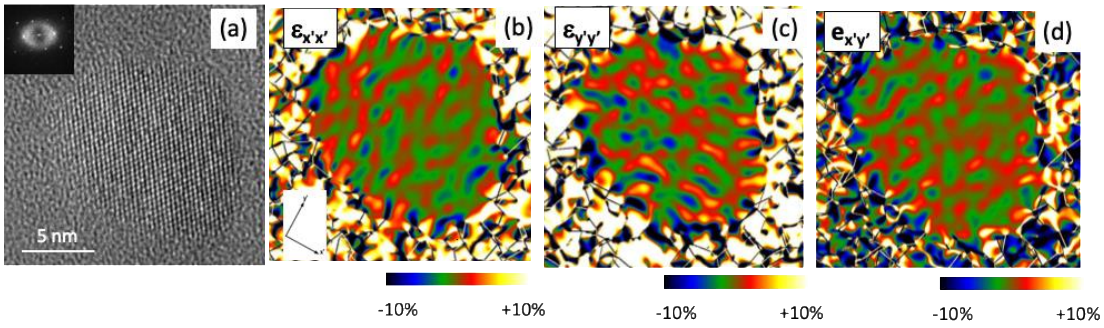

Figure S1: **(a) High Resolution Transmission Electron Microscopy (HREM) image of sample P5FG (P dose 3×10^{15} ions/cm^2) seen along the zone axis [110]; inset: associated FFT. Maps of strain components inside the nanocrystal (NC) extracted with respect to the Si Bravais lattice: in plane strain $\varepsilon_{x'x'}$ (b), out of plane $\varepsilon_{y'y'}$ (c) and shear $\varepsilon_{x'y'}$ (d) strain components, measured using the absolute strain measurement method[26, 27]. The average values are -0.05%, -0.03% and -0.02% for respectively ($\varepsilon_{x'x'}$), ($\varepsilon_{y'y'}$) and ($\varepsilon_{x'y'}$).**

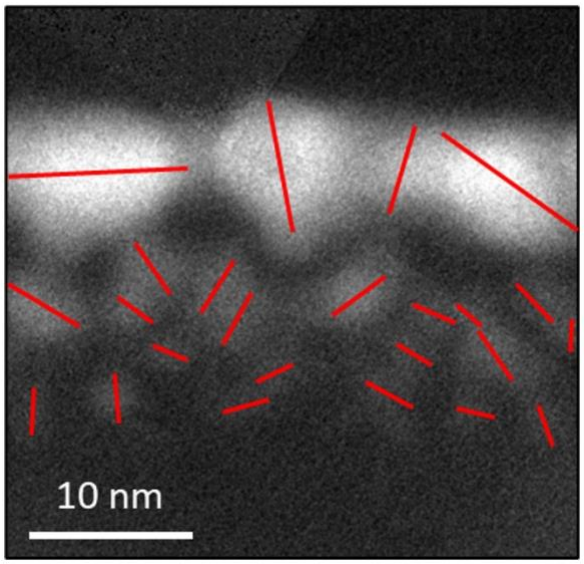

Figure S2: **Methodology for nanocrystal size analysis.**

By using the largest distance (red line) as the diameter of one nanocrystal (NC), we manually measured the NCs as indicated in Figure S2 (EFTEM image of P4FG sample for example). For each sample, the average size was determined using more than 140 NCs. We set the error bar of the big NCs at 1 nm and the error bar for small NCs at 0.5 nm due to the difficulty in distinguishing the NC boundaries.

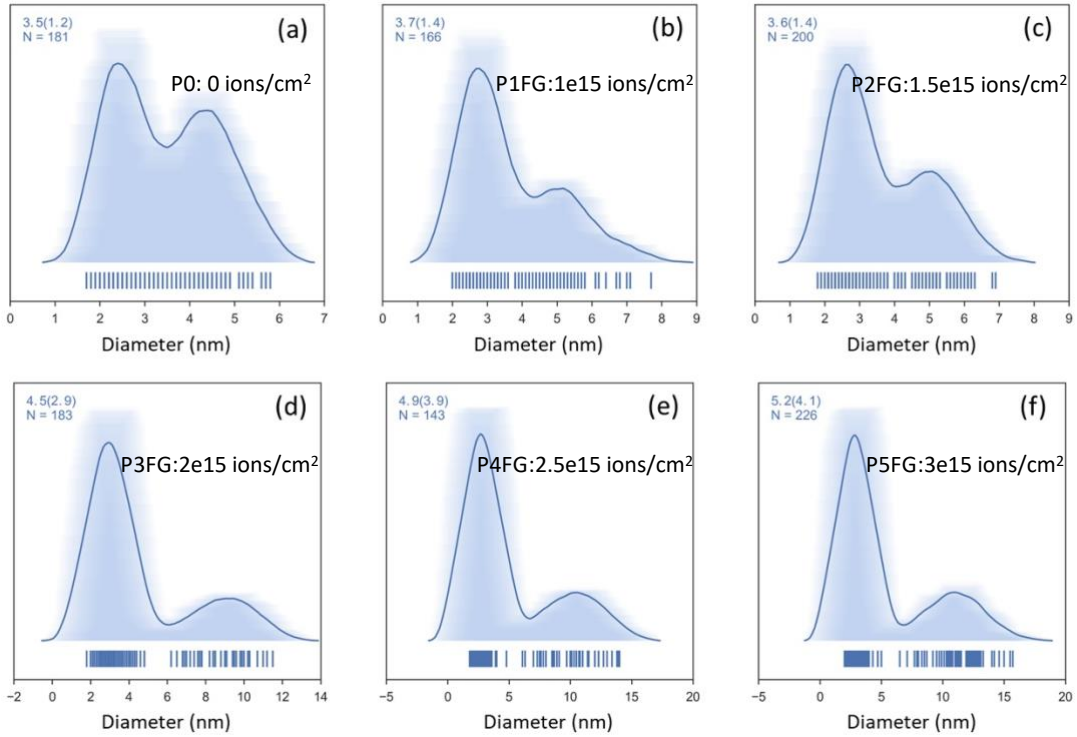

Figure S3: **Average shifted histograms (ASH) of nanocrystal size showing the bimodal size-distributions of undoped (a) and phosphorus doped (b-f) SiNCs.**