List of Figures

Figure 1.1: A scale to show the relative size of various objects……..... 01

Figure 1.2: Classification of material into 0- D, 1- D, 2-D and 3- D and their respective density of states as a function of dimension……..… 03

Figure 1.3: Difference in the bandgaps between insulator, semiconductor and conductor as a function of energy……... 04

Figure 1.4: Different colors of gold nanoparticles and their respective light absorbance in terms of wavelength……..……... 05

Figure 1.5 : An illustration to show coercivity-size relations of nanoparticles[10]… 06

Figure 1.6 : Schematic representation of Young's modulus as a function of strength for Different objects…….. 07

Figure 3.1: Size dependent melting temperature of (a) spherical Ag NPs (b) tetrahedral Ag NPs (c) icosahedral Ag NPs……... 34

Figure 3.2: Size dependent melting temperature of (a) spherical In NPs (b) In nanowire (c) In thin film…….…… 36

Figure 3.3: Size dependent melting temperature of (a) spherical Pb NPs (b) cylindrical Pb nanowire (c) Pb NPs with different dimension…… 37

Figure 3.4: Size dependent melting temperature of embedded Ag nanoparticles in Ni matrix for (a) icosahedral (b) different shapes (c) different dimensions……... 39

Figure 3.5: Size dependent melting temperature of In nanoparticles embedded in Al matrix for (a) spherical (b) different dimensions (c) different shapes…….. 40

Figure 3.6: Size dependent melting temperature of Pb nanoparticles embedded in Al matrix for (a) spherical (b) different dimensions (c) different shapes…….. 41

Figure 3.7: Size dependent ratio of catalytic activation energies of free Pt NPs for (a) different shapes and (b) different dimensions…… 44

Figure 3.8: Size and shape dependent ratio of catalytic activation energies of embedded Pt NPs in Zr…… 45

Figure 3.9: Size-dependent catalytic activation energy of Platinum for sphere, cube and tetrahedron nanoparticles with different models and experimental results……. 46

Figure 4.1: Size (D) dependent glass transition temperature (T_g) of tantalum nanoparticles……..... 52
Figure 4.2: Size and dimension dependent glass transition temperature (T_g) of Ta nanoparticles……..…….. 52
Figure 4.3: Size and shape dependent glass transition temperature (T_g) of Ag nanoparticles ……... 53
Figure 4.4: Size (D) and dimension (d) dependent glass transition temperature (T_g) of Ag nanoparticles……..…… 53
Figure 4.5: Size dependent Kauzmann temperature of Ag nanoparticles…….. 56
Figure 4.6: Size and dimension dependent Kauzmann temperature of Ag nanoparticles…… 56
Figure 4.7: Size dependent Kauzmann temperature (T_K) of Ta nanoparticles……. 57
Figure 4.8: Size and dimension dependent Kauzmann temperature (T_K) of Ta nanoparticles ……..…… 57
Figure 4.9: Variation in melting, glass and Kauzmann temperature of Ag nanoparticles as a function of size (D)…… 58
Figure 4.10: Variation in melting, glass and Kauzmann temperature of Ta nanoparticles as a function of size (D)…… 58
Figure 4.11: Comparison of surface to volume ratio of atoms (N_1/n_1) for different shapes with inverse size (D^{-1}) for Ag and Ta NPs…….. 60
Figure 4.12: Comparison of surface to volume ratio of atoms (N_1/n_1) for different dimensions with inverse size (D^{-1}) for Ag and Ta NPs……... 60
Figure 5.1: Size dependent melting temperature of free and embedded virus……... 72
Figure 5.2: Size-dependent catalytic activity of free and embedded virus…… 73
Figure 5.3: Size dependent glass transition temperature of free virus……... 74
Figure 5.4: Temperature dependent low-frequency vibration curve for a free and embedded virus (a) for 25 nm and (b) 50 nm……..…… 75