Colloidal Electronics

by

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Technical Summary

Arming nano-electronics with mobility extends artificial systems into traditionally inaccessible environments. Carbon nanotubes (1D), graphene (2D) and other low-dimensional materials with well-defined lattice structures can be incorporated into polymer microparticles, granting them unique electronic functions. The resulting **colloidal electronic** 'cells', comprised of microscopic circuits connecting artificial 'organelles' (*e.g.*, generators, sensors, logic gates, *etc.*), combine the modularity of modern electronics with the characteristic mobility found in dispersive colloidal systems.

Fundamental to **colloidal electronics** lie two challenges: **(1)** providing electrical energy to a microscopic system with limited footprint; and **(2)** developing energy efficient electronic devices and circuitries with low power consumption. In this context, my thesis introduces two concepts – ***Autoperforation*** and ***Asymmetric Chemical Doping*** – as means to fabricate and power electronic circuit elements on top of colloidal particles. These advances allow us to build the first **colloidal electronic** system that perform autonomous functions integrating energy harvesting, chemical detection and digital memory recording – all within a form-factor no larger than biological cells.

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