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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