Local conductance and saturation lengths of atomic wires dipped in a conducting medium

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The dependence of the total electric current and the local current density as a function of submerged length is studied for a model nanowire partially dipped in a disordered conducting medium. We show that the highest conductance is available if the contact is made weak and long, while a strongly coupled contact results in poor conductance. Oscillatory behavior is found superimposed to the current increase, as the wire is being dipped. The oscillations vanish at long enough dippng, and the current asymptotically approaches a saturation value which is very much influenced by the coupling strength between the wire and the medium. A relationship is found between the saturation length and saturation value of the current. Numerical estimates are provided for these quantities as a function of the coupling strength between a carbon nanotube and a conducting medium. A related experimental study is proposed.