The Formation, Properties and Application of Super-Long Nanochains

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This project presents the newly found phenomenon of formation of super-long chains of nanoparticles. I can produce such chains up to 60 cm long. Five methods of formation of these nanochains were developed. They are based on laser or plasma evaporation of metals, the combination of plasma heating and laser evaporation or the combination of resistive heating and laser evaporation of materials, the electrical explosion of metal wires. I have already produced molybdenum oxide nanochains (max length 60 cm) and lead oxide nanochains (max length 2.5 cm). Creation of nanochains takes place when turbulence vortexes are generated in dense flow of metal vapor resulting in its strong compression due to centrifugal force and subsequent condensation. Dimensions of nanoparticles can be regulated from 20 nm to 200 nm by evaporation conditions. Such chains can be used in detectors of radiation and devices for direct conversion of ionizing or solar radiation to electricity that use the principle of emission of electrons from irradiated nanoparticles. The conductive nanochains are inserted into liquid electrolyte providing direct transformation radiation to electricity due to emission of photoelectrons. Such nanochains adjusted for complementary capture of biomolecules or microorganisms can be used as biosensors. When microorganisms or molecules are captured by the nanochain its physical parameters like electrical conductivity or optical resonance scattering will be changed providing registration of these micro objects. Hence, the phenomenon of formation of super-long nanochains was discovered, five methods of forming of such structures were developed, detectors of radiation, devices for direct radiation conversion to electricity and biosensors based on nanochains were developed.