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# Robust composite silk fibers pulled out of silkworms directly fed with nanoparticles

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**Abstract:** This paper reports the impacts of direct feeding silkworms with different nanoparticles (Cu, Fe, and TiO<sub>2</sub>) on the morphology, structures, and mechanical properties of the resulting silk fiber (SF). The contents of the Cu nanoparticles were 38 times higher in the posterior silk glands and only 2-3 times higher in the SF and in the middle silk glands compared with the controlled groups. Significant changes of the surface morphology, structures, and diameter of the Cu nanoparticle fed SF have

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