

# Polymer/Trimer/Metal Complex Mixtures as Precursors of Gold Nanoparticles: Tuning the Morphology in the Solid-State

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The pyrolysis of several physical mixtures of AuCl(PPh<sub>3</sub>) with polymeric [NP(O<sub>2</sub>C<sub>12</sub>H<sub>8</sub>)<sub>n</sub> or cyclic N<sub>3</sub>P<sub>3</sub>(O<sub>2</sub>C<sub>12</sub>H<sub>8</sub>)<sub>3</sub> phosphazenes, formed as solid powders or films with different molar ratios, have been studied under air and at 800 °C. The characterization of the products has shown that the particle size and morphology are strongly dependent on the nature of the phosphazene, the phosphazene/AuCl(PPh<sub>3</sub>) molar ratio and on the preparation methodology. Gold nanoparticles (NPs) with mean sizes as small as 3.5 nm were obtained from a [NP(O<sub>2</sub>C<sub>12</sub>H<sub>8</sub>)<sub>n</sub>/AuCl(PPh<sub>3</sub>) 1:1 film. The particle morphology was also strongly dependent on the experimental conditions of the pyrolysis. Powdered materials exhibit a 3-D irregular morphology in the mixture [NP(O<sub>2</sub>C<sub>12</sub>H<sub>8</sub>)<sub>n</sub>/AuCl(PPh<sub>3</sub>) 3:1 film, and gold foams in the 1:1 ratio, both from the [NP(O<sub>2</sub>C<sub>12</sub>H<sub>8</sub>)<sub>n</sub>/AuCl(PPh<sub>3</sub>) as well as N<sub>3</sub>P<sub>3</sub>(O<sub>2</sub>C<sub>12</sub>H<sub>8</sub>)<sub>3</sub>/AuCl(PPh<sub>3</sub>) mixtures. These results show for the first time the possibility of controlling mor