CLAIMS

That Which is Claimed is:

1. A composition useful as a selective hydrogenation catalyst or selective hydrogenation catalyst precursor,

wherein said composition comprises a carrier containing bi-metallic nanoparticles,

wherein said bi-metallic nanoparticles comprise a silver component and a palladium component and have a mean particle size in the range of from 1 nm to 10 nm and an overall molar ratio of palladium-to-silver in the range of from 0.01:1 to 100:1, and

wherein said composition comprises a total silver content in the range of from 0.01 wt.% to 1 wt.% and a total palladium content in the range of from 0.01 wt.% to 1 wt.% with the weight percent silver is based on the metal and the weight percent palladium is based on the metal,

wherein said bi-metallic nanoparticles include core-shell nanoparticles, and

wherein the carrier is a shaped inorganic carrier and a dispersion of the bi-metallic nanoparticles on a surface of the carrier is in the range of from 0.01% and 22% of the BET surface area of the carrier, as measured by H_2 Chemisorption.

2. The composition as recited in claim 1, wherein said bi-metallic nanoparticles include metal alloy nanoparticles comprising silver and palladium.

3. The composition as recited in claim 1, wherein said bi-metallic nanoparticles includethe core-shell nanoparticles comprising comprise a core having a first major portion that is palladium and a shell surrounding said core and having a second major portion that is silver.

4. The composition as recited in claim 1, wherein said bi-metallic nanoparticles includethe core-shell nanoparticles comprising comprise a core having a first major portion that is silver and a shell surrounding said core and having a second major portion that is palladium.

5. The composition as recited in claim 1,

wherein said carrier, comprises an inorganic oxide, and is a shaped structure defined by a shape having an outer shell region and an interior region,

wherein said bi-metallic nanoparticles are concentrated in said outer shell region, and

wherein said shape is selected from the group consisting of spheres, cylindrical pellets, and extrudates that are either cylinders or lobed shapes,

wherein said spheres have a spherical diameter in the range of from 0.5 mm to 25 mm, said cylindrical pellets have a pellet diameter in the range of from 0.5 mm to 25 mm and a pellet length of from 1 mm to 50 mm, and said extrudates have an extrudate diameter in the range of from 0.5 mm to 25 mm, and an extrudate length in the range of from 1 mm to 50 mm.

6. The composition as recited in claim 5, wherein said outer shell region has a depth from ~~said~~ an outer surface is in the range of from 1 micron to 400 microns.

7. A method of making a composition useful as a selective hydrogenation catalyst or selective hydrogenation catalyst precursor, wherein said method comprises:

providing an aqueous dispersion of bi-metallic nanoparticles formed by the reduction of a palladium salt and a silver salt in a mixture by the application of a surfactant, wherein the bi-metallic nanoparticles include a core-shell structure,

wherein said surfactant is selected from the group consisting of cationic surfactants, anionic surfactants, and nonionic surfactants,

wherein said silver salt is selected from the group of silver salts consisting of silver nitrate, silver halide, silver carbonate, silver phosphate, silver acetate, silver hydroxide, silver oxide, and silver sulfate, and

wherein said palladium salt is selected from the group of palladium salts consisting of palladium nitrate, palladium halide, palladium carbonate, palladium phosphate, palladium acetate, palladium oxide and palladium sulfate;

incorporating said aqueous dispersion into a carrier to provide an impregnated carrier; and

drying said impregnated carrier followed by calcining said impregnated carrier in air at a low calcination temperature in the range of from 250 ^{o}C to 600 ^{o}C to provide said composition.

8. The method as recited in claim 7, wherein said providing step comprises:

mixing in water, said palladium salt, said silver salt, and said surfactant to provide said mixture; and

heating said mixture at a low heating temperature in the range of from 30 ºC up to 100 ºC and ~~said heating period is up to 24 hours and~~ for a heating period sufficient to thereby provide said aqueous dispersion.

9. The method as recited in claim 7, wherein said bi-metallic nanoparticles provide for a molar ratio of palladium-to-silver in said aqueous dispersion in the range of from 0.01:1 to 100:1 based on the total weight of said aqueous dispersion that includes both a continuous phase and a discontinuous phase.

10. The method as recited in claim 7, wherein said surfactant is selected from the group of anionic surfactants consisting of organo sulfate compounds, organo sulfite compounds, organo sulfonate compounds, organo phosphate compounds, and organo carboxylate compounds.

11. The method as recited in claim 7, wherein said surfactant is selected from the group of cationic surfactant compounds consisting of ammonium salts of primary amines, secondary amines, and tertiary amines.

12. The method as recited in claim 7, wherein said surfactant is selected from the group of nonionic surfactants consisting of ethoxylates, fatty alcohol ethoxylates, alkylphenol ethoxylates, and fatty acid esters.

13. The method as recited in claim 7, wherein said carrier is a shaped structure, comprising an inorganic oxide and having a shape selected from the group consisting of spheres, cylindrical pellets, and extrudates that are either cylinders or lobed shapes, wherein said spheres have a spherical diameter in the range of from 0.5 mm to 25 mm, said cylindrical pellets have a pellet diameter in the range of from 0.5 mm to 25 mm and a pellet length of from 1 mm to 50 mm, and said extrudates have an extrudate diameter in the range of from 0.5 mm to 25 mm, and an extrudate length in the range of from 1 mm to 50 mm, and wherein said shaped structure is defined as having an outer shell region and an interior region.

14. The method as recited in claim 7, wherein said incorporating step is either a wet impregnation or an incipient wetness impregnation providing for incorporation and concentration of said bi-metallic nanoparticles within said outer shell region having a depth in the range of from 1 micron to 400 microns.

15. The method as recited in claim 7, wherein said aqueous dispersion includes concentrations of silver and of palladium so that upon incorporation into said carrier and calcination of said impregnated carrier said composition comprises from 0.01 wt.% to 1 wt.% silver, based on the weight of said composition and silver as metal, and 0.01 wt.% to 1 wt.% palladium, based on the weight of said composition and palladium as metal.

16. The selective hydrogenation process, comprising: contacting under suitable selective hydrogenation reaction conditions an olefins stream that has a contaminating concentration of highly unsaturated hydrocarbons with any one of the catalysts recited in claims 1-6 or with any one of the catalysts made by a method recited in claims 7-15, and yielding a treated olefins stream having a reduced concentration of highly unsaturated hydrocarbons.