1. **PdAu nanoparticles (1:5 molar ratio) preparation using Sodium carboxyl methyl cellulose as stabilizing & NaBH4 reducing agent**

**Materials:**

13.23 mg Na2PdCl4 (Sigma-Aldrich)

1.89 g NaBH4 (Sigma-Aldrich)

88.61 mg HAuCl4.3H2O (Sigma-Aldrich)

150 mg Sodium carboxyl methyl cellulose (Average Mw = 90,000 g/mole) Sigma-Aldrich

100 ml size three neck flask

Nitrogen gas, high purity

Measuring cylinders

50 ml Erlenmeyer’s

Proper size pipettes, pipettors, pipette tips, stir plates, stoppers

**Nanoparticle preparation:**

1. 13.23 mg Na2PdCl4 was transferred into 100 ml size three neck flask and dissolved in 15 ml of heavy water (D2O) for 30 minutes.
2. 150 mg of sodium carboxyl methyl cellulose was dissolved in 10 ml nitrogen-bubbled heavy water and added to the solution mentioned in step 1. The mixture was stirred for 1 hour.
3. 88.61 mg HAuCl4 was dissolved in 15 ml D2O and stirred for 2 hours. The gold salt solution was added to Pd-CMC mixture in step 2 and stirred for 3 hours.
4. 1.89 g NaBH4 was added to 10 ml nitrogen-bubbled heavy water (5.0 M NaBH4 solution) was used to reduce Pd-CMC-Au mixture in step 3.
5. The color of the solution changed from pale yellow to dark brown pH = 9. The Pd-Au nanoparticles was washed thoroughly with 50 ml water and purified using centrifuge.

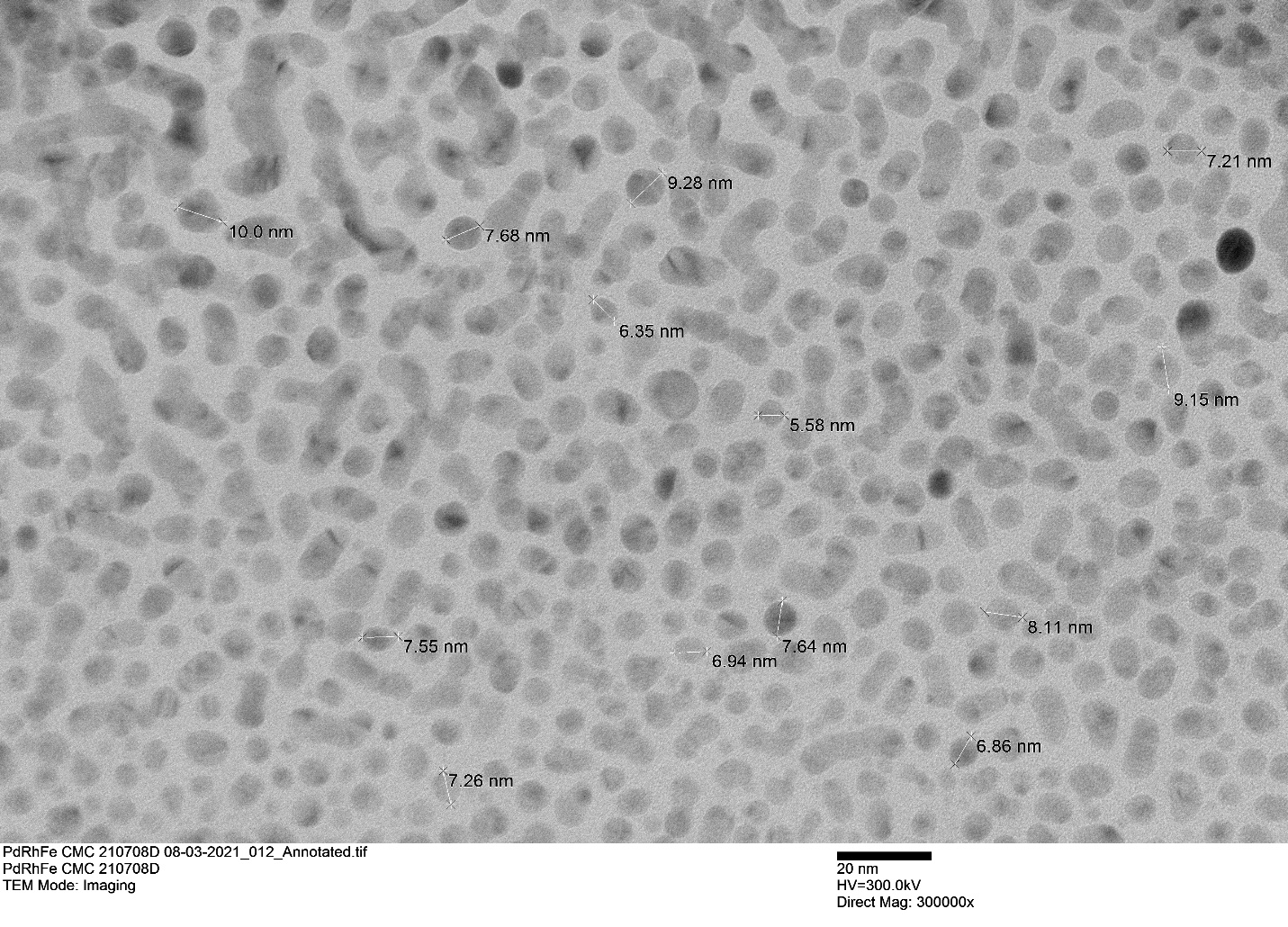


Figure 1. TEM image of PdRhFe nanoparticles



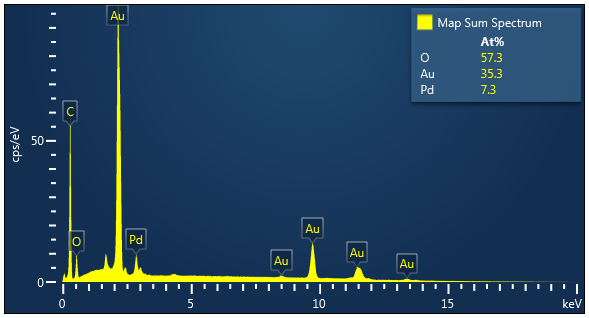


Fig. 2. EDS images Pd-Au (1:5 molar ratio)

1. **PdAu nanoparticles (5:1 molar ratio) preparation using Sodium carboxyl methyl cellulose as stabilizing & NaBH4 reducing agent**

**Materials:**

66.19 mg Na2PdCl4 (Sigma-Aldrich)

378 mg NaBH4 (Sigma-Aldrich)

15 mg HAuCl4.3H2O (Sigma-Aldrich)

150 mg Sodium carboxyl methyl cellulose (Average Mw = 90,000 g/mole) Sigma-Aldrich

100 ml size three neck flask

Nitrogen gas, high purity

Measuring cylinders

50 ml Erlenmeyer’s

Proper size pipettes, pipettors, pipette tips, stir plates, stoppers

**Nanoparticle preparation:**

1. 66.19 mg Na2PdCl4 was transferred into 100 ml size three neck flask and dissolved in 15 ml of heavy water (D2O) for 30 minutes.
2. 150 mg of sodium carboxyl methyl cellulose was dissolved in 10 ml nitrogen-bubbled heavy water and added to the solution mentioned in step 1. The mixture was stirred for 1 hour.
3. 15 mg HAuCl4 was dissolved in 15 ml D2O and stirred for 2 hours. The gold salt solution was added to Pd-CMC mixture in step 2 and stirred for 3 hours.
4. 378 mg NaBH4 was added to 10 ml nitrogen-bubbled heavy water (1.0 M NaBH4 solution) was used to reduce Pd-CMC-Au mixture in step 3.
5. The color of the solution changed from pale yellow to dark brown pH = 9. The Pd-Au nanoparticles was washed thoroughly with 50 ml water and purified using centrifuge.

**Pd NANOPARTICLES USING** **ETHYLENE GLYCOL** **WAS ACHIEVED (POLYOL METHOD)**

The synthesis was done with 90.4 mg Pd(OAc)2 dissolved in 25 ml ethylene glycol (EG) at 125oC for 1 hour with a stirring rate of 60 rpm under nitrogen environment. See TEM image below Fig. 3

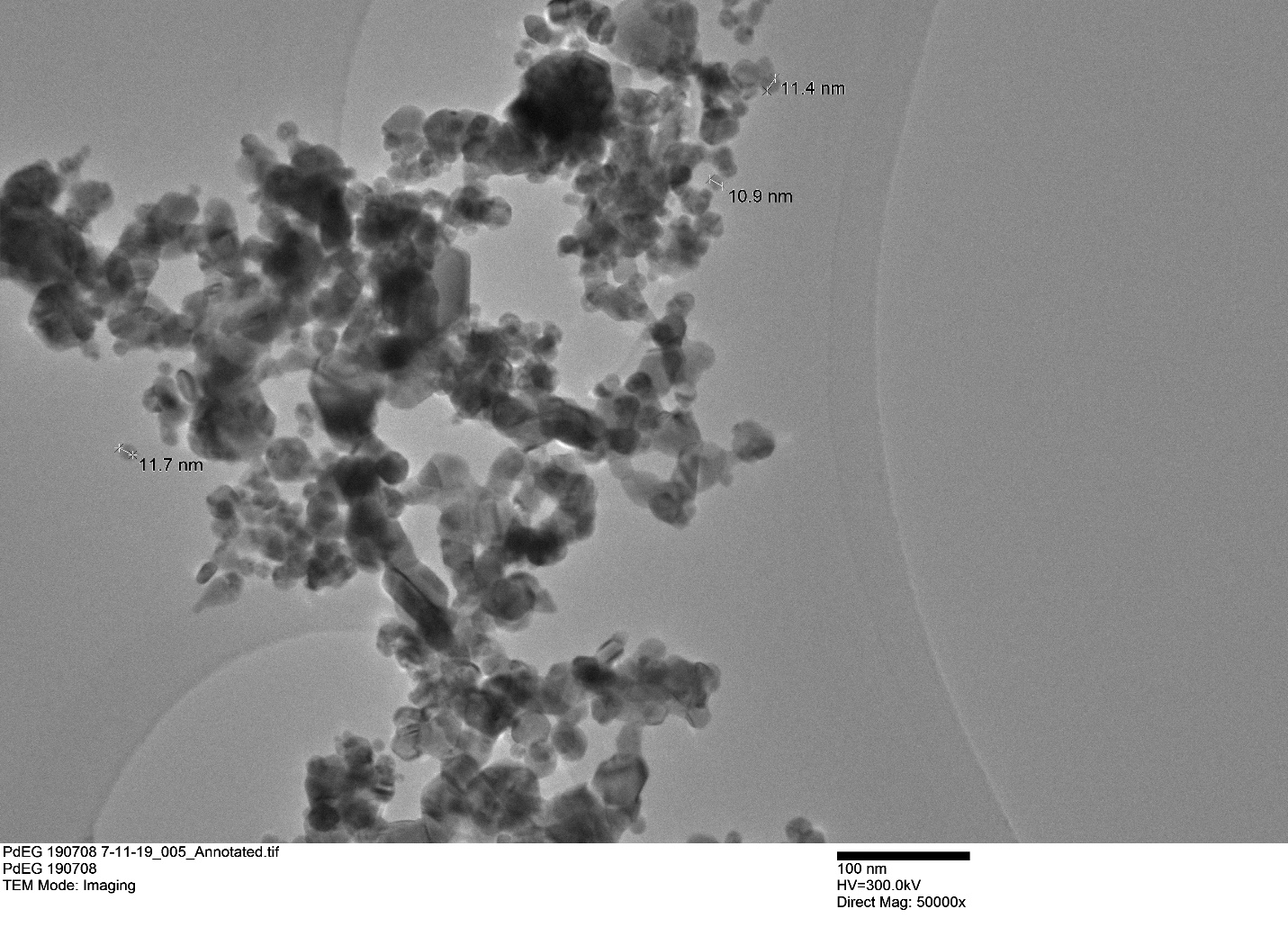


Figure 3. TEM image of palladium nanoparticles synthesized with ethylene glycol

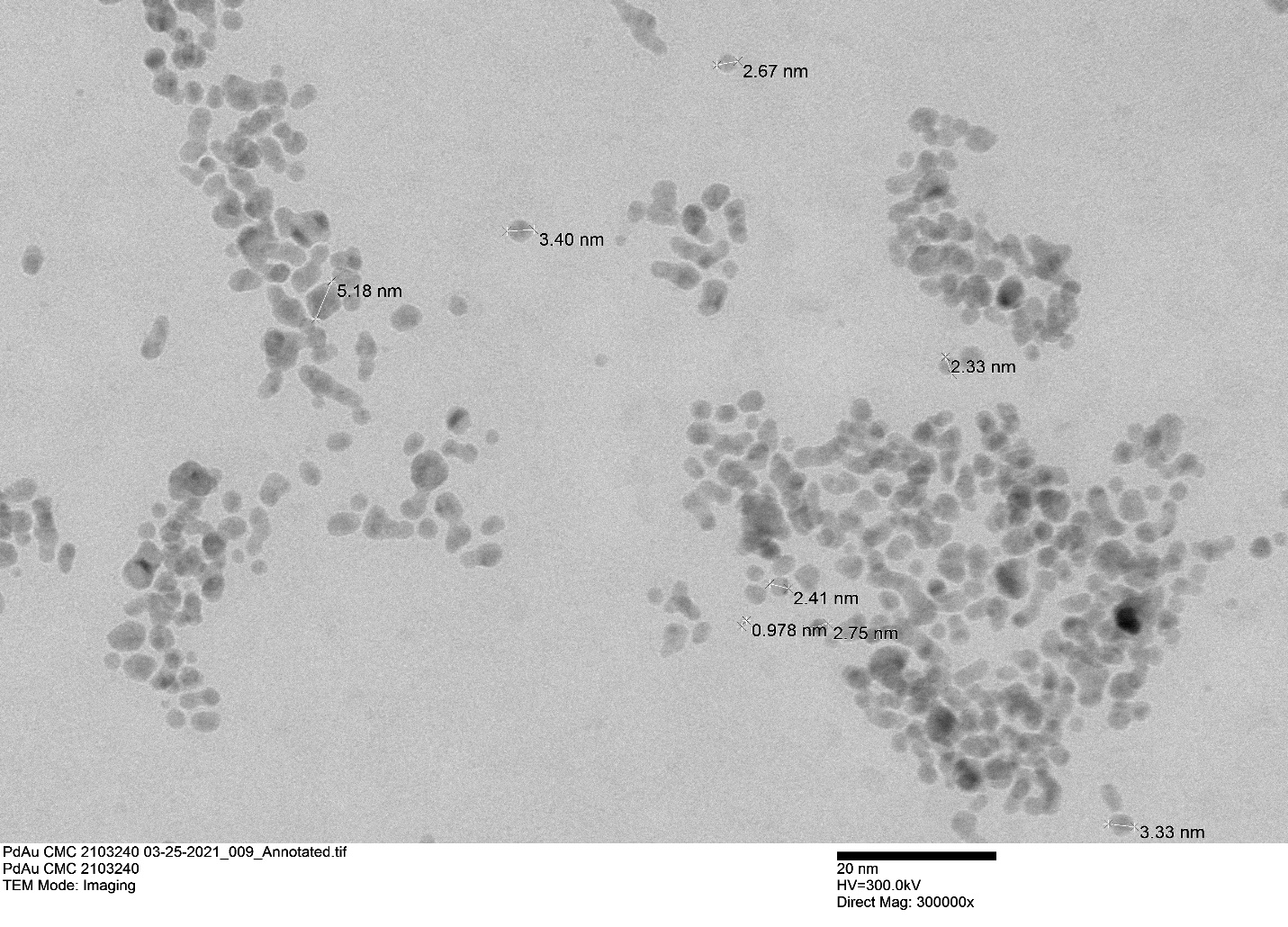
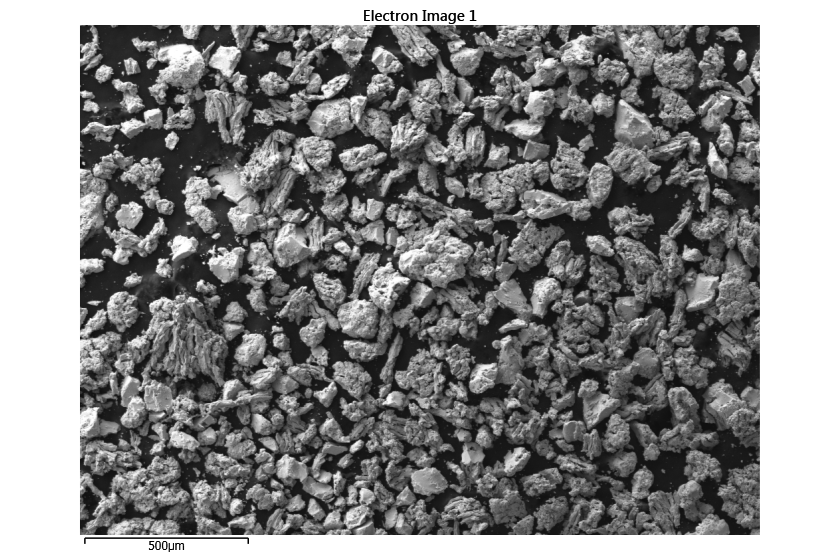
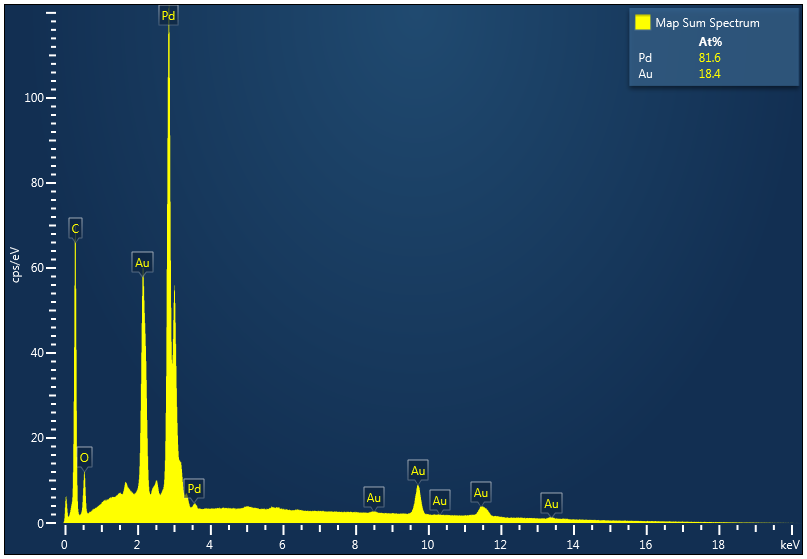


Fig. 4. TEM Image Pd-Au nanoparticles (5:1 molar ratio)



Fig. 5. EDS images Pd-Au (5:1 molar ratio)

1. **PdRh nanoparticles preparation using Sodium carboxyl methyl cellulose as stabilizing agent and NaBH4 as reducing agent**

**Materials:**

40 mg Na2PdCl4 (Sigma-Aldrich)

15 mg RhCl3 (VWR)

378 mg NaBH4 (Sigma-Aldrich)

150 mg Sodium carboxyl methyl cellulose (Average Mw = 90,000 g/mole) Sigma-Aldrich

50 ml size three neck flask

Nitrogen gas, high purity

Measuring cylinders

50 ml Erlenmeyer’s

Proper size pipettes, pipettors, pipette tips, stir plates, stoppers, thermometer

**Nanoparticle preparation:**

1. Distilled water was bubbled under nitrogen for 30 minutes.
2. Transfer 40 mg Na2PdCl4 into 50 ml size three neck and 15 ml distilled water was added. Then stirred for 15 minutes. 15 mg of RhCl3 salt was dissolved in 50 ml of distilled water. 15 ml of the Rhodium salt solution (stock solution) was added to the Pd-CMC mixture.
3. 150 mg Sodium carboxyl methyl cellulose dissolved in 10 ml of water was added as a stabilizing agent and allow to stir for 1 hour.
4. 378 mg NaBH4 was dissolved in 10 ml of distilled water and added to the mixture in step 3 at 25oC. The color changed from pale yellow to dark brown when the NaBH4 solution (reducing agent) was added dropwise. pH = 9. The Pd-Au nanoparticles was washed thoroughly with 50 ml water and purified using centrifuge.

**Palladium nanoparticles synthesis with** **(−)-Epigallocatechin gallate:** 21.5 mg Na2PdCl4 was transferred into 50 ml size three neck flask and 16 mg (−)-Epigallocatechin gallate (EGCG) was added and stirred in a nitrogen environment. A dark-brown coloration was observed when 40 ml of D2O was introduced to the mixture and stirred 500 rpm for 24 hours at room temperature.

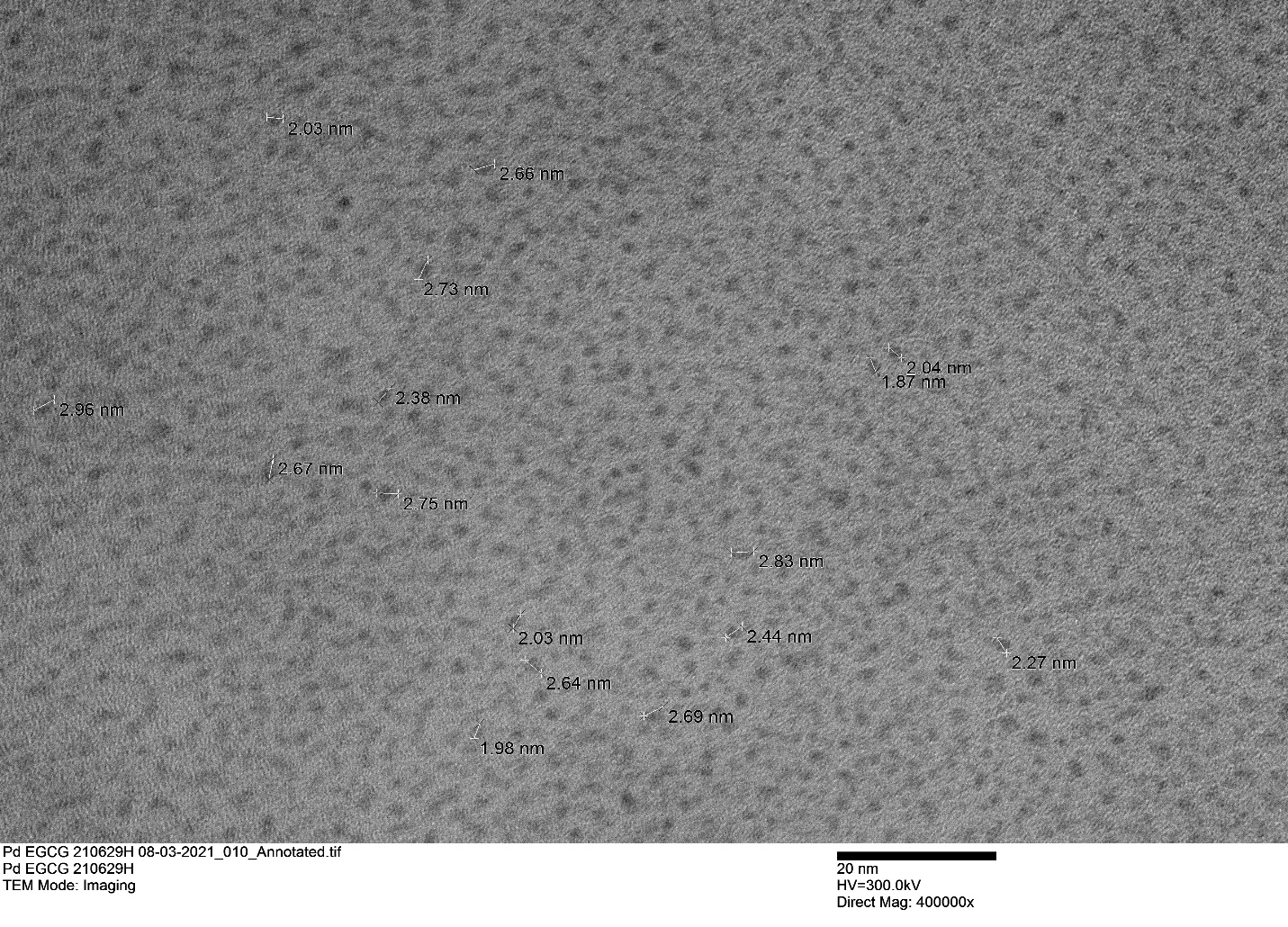


Figure 6. TEM images of palladium nanoparticles synthesized with (−)-Epigallocatechin gallate (EGCG)

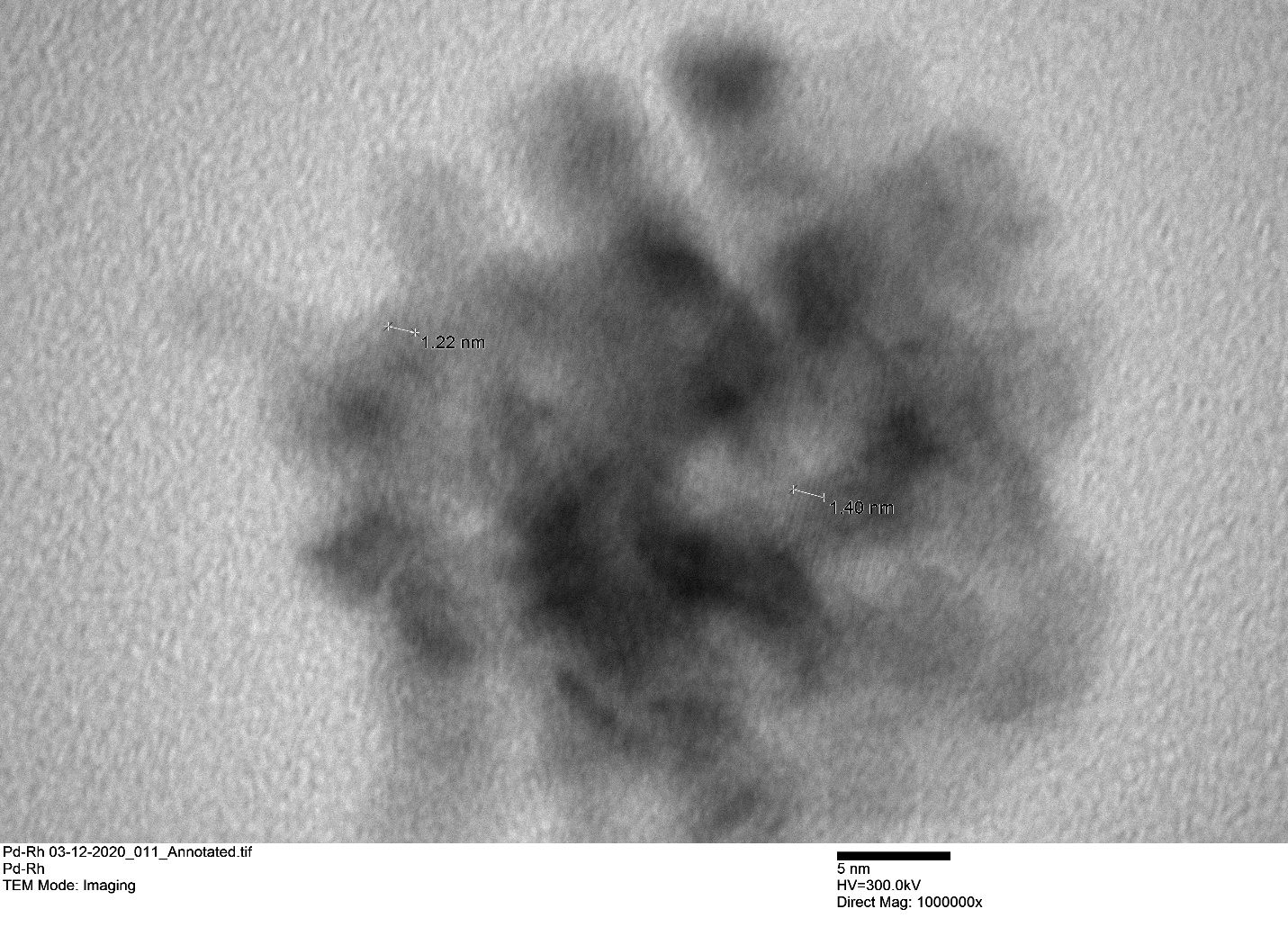


Fig. 7. TEM image Pd-Rh nanoparticles



Fig. 8. SAED Diffraction pattern Pd-Rh nanoparticles



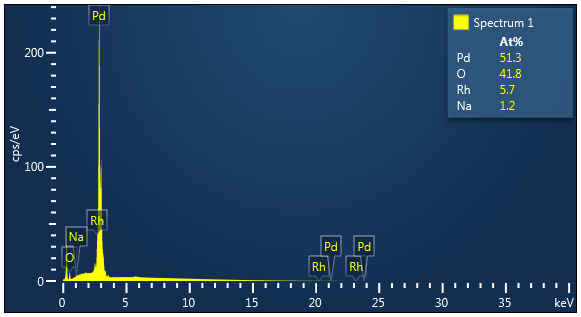


Fig. 9. EDS images Pd-Rh nanoparticles