CLAIMS

1. A method for preparing adamantane-intercalated layered double-hydroxide (LDH) particles, the method comprising:

adding to an aqueous solution a first precursor and a second precursor to form an initial mixture, where:

the first precursor is $Al(OH)_3$ or Al_2O_3;

the second precursor is a hydroxide $M(OH)_2$ or an oxide MO, where M is a metal of oxidation state +2; and

the initial mixture has a M/Al molar ratio from 1 to 5;

the initial mixture has a solid loading of less than 10 weight % solids, based on a total weight of the initial solution;

adding to the initial mixture an amount of adamantane to form a reaction mixture having an Al/adamantane molar ratio from 0.5 to 2; and

heating the reaction mixture to produce the adamantane-intercalated LDH particles, where the adamantane-intercalated LDH particles have an aspect ratio greater than 100, the aspect ratio defined by a width of an adamantane-intercalated LDH particle divided by a thickness of the adamantane-intercalated LDH particle.

2. The method of claim 1 further comprising stirring the reaction mixture.

3. The method of claim 1 where the adamantane is added as a carboxylic acid.

4. The method of claim 1 where the heating step occurs at a reaction temperature from 110 °C to 180 °C for a reaction time of 12 hours to 48 hours.

5. The method of claim 1 where M is chosen from Mg, Ca, Co, Ni, Cu, or Zn.

6. The method of claim 1 where the second precursor is $Mg(OH)_2$, $Ca(OH)_2$, $Co(OH)_2$, $Ni(OH)_2$, $Cu(OH)_2$, or $Zn(OH)_2$.

7. The method of claim 1 where the second precursor is $Mg(OH)_2$ or MgO.

8. The method of claim 1 where the second precursor is $Mg(OH)_2$ and the first precursor is $Al(OH)_3$.

9. The method of claim 1 where the Al/adamantane molar ratio is from 0.8 to 1.2.

10. The method of claim 1 where the adamantane-intercalated LDH particles have a general formula $[M_{1-x}Al_x(OH)_2](A)_x \cdot mH_2O$, where x is from 0.14 to 0.33, m is from 0.33 to 0.50, M is chosen from Mg, Ca, Co, Ni, Cu, or Zn, and A is adamantane carboxylate.

11. The method of claim 1 where the initial mixture has less than 5 weight % solids, based on the total weight of the initial mixture.

12. The method of claim 1 where the aspect ratio is greater than 125.

13. An adamantane-intercalated layered double-hydroxide (LDH) material in a form of adamantane-intercalated LDH particles, where the adamantane-intercalated LDH particles comprise:

a general formula defined by $[M_{1-x}Al_x(OH)_2](A)_x \cdot mH_2O$, where x is from 0.14 to 0.33, m is from 0.33 to 0.50, M is chosen from Mg, Ca, Co, Ni, Cu, or Zn, and A is adamantane carboxylate; and

an aspect ratio greater than 100, the aspect ratio defined by a width of an adamantane-intercalated LDH particle divided by a thickness of the adamantane-intercalated LDH particle.

14. The adamantane-intercalated LDH material of claim 13 where the aspect ratio is greater than 125.

15. The adamantane-intercalated LDH material of claim 13 where the adamantane-intercalated LDH particles have a particle diameter of 5 to 10 μm.