WHAT IS CLAIMED IS:

1. A lithium lanthanum zirconium oxide (LLZO) powder comprising:

LLZO particles;

wherein the LLZO particles have a D50 between ~~about~~ 20 nm and ~~about~~ 500nm, D10 of greater than or equal to D50÷4, and D90 less than or equal to D50×4;

wherein the LLZO particles have a sphericity factor of greater than ~~about~~ 0.6, and

wherein a structure of the LLZO particles is a crystalline garnet structure and/or an amorphous structure.

2. The LLZO powder of Claim 1, wherein the D10 is ~~approximately~~ equal to D50÷2.

3. The LLZO powder of any one of Claims 1-2, wherein the D90 is ~~approximately~~ equal to D50×2.

4. The LLZO powder of any one of Claims 1-3, wherein the LLZO particles have a D50 between ~~about~~ 50 nm and ~~about~~ 500 nm.

5. The LLZO powder of any one of Claims 1-3, wherein the D50 is between ~~about~~ 100 nm and ~~about~~ 400 nm.

6. The LLZO powder of any one of Claims 1-3, wherein the D50 is between ~~about~~ 150 nm to ~~about~~ 300 nm.

7. The LLZO powder of any one of Claims 1-6, wherein the LLZO particles have a stoichiometry of $Li_{7-3x}M1_xLa_3Zr_2O_{12}$, M1 is Al, B, or Ga, and x is ~~about~~ 0.1 to 0.3.

8. The LLZO powder of any one of Claims 1-6, wherein the LLZO particles have a stoichiometry of $Li_{7-y}La_3Zr_{2-y}M2_yO_{12}$, M2 is Ta or Nb, and y greater than or equal to ~~about~~ 0.4.

9. The LLZO powder of any one of Claims 1-6, wherein the LLZO particles have a stoichiometry of $Li_{7-3nx}M1_xLa_3Zr_{2-my}M2_yO_{12}$, M1 is a low atomic mass metal, x is ~~about~~ 0.1 to 0.3, and n can depend on the valence of M1.

10. The LLZO powder of any one of Claims 1-6, wherein the LLZO particles have a stoichiometry of $Li_{7-3nx}M1_xLa_3Zr_{2-my}M2_yO_{12}$, y greater than or equal to ~~about~~ 0.4, and m can depend on the valence of M2.

11. The LLZO powder of any one of Claims 1-10, wherein the LLZO particles are crystalline.

12. The LLZO powder of Claim 11, wherein the crystalline structure of the LLZO particles is a garnet crystalline structure.

13. A solid state battery comprising:

an anode;

a cathode;

a solid electrolyte; and

a separator;

wherein either the anode, cathode or separator comprises LLZO particles;

wherein the LLZO particles have a D50 between ~~about~~ 20 and ~~about~~ 500nm, D10 of greater than or equal to D50÷4, and D90 less than or equal to D50×4;

wherein the LLZO particles have a sphericity factor of greater than ~~about~~ 0.6, and

wherein a structure of the LLZO particles is a crystalline garnet structure.

14. The solid state battery of Claim 13, wherein the separator comprises the LLZO particles.

15. The solid state battery of Claim 14, wherein the separator is a composite or a ceramic non-composite separator.

~~16. A method for manufacturing a LLZO powder comprising:~~

~~preparing a LLZO feedstock of metallic salts comprising lithium, lanthanum, zirconium, tantalum, and a dopant;~~

~~introducing the LLZO feedstock into a microwave plasma torch, a plasma plume of the microwave plasma torch, and/or an exhaust of the microwave plasma torch; and~~

~~pyrolyzing the LLZO feedstock within the microwave plasma torch, the plasma plume of the microwave plasma torch, and/or the exhaust of the microwave plasma torch to form spheroidized LLZO powder.~~

~~17. The method of Claim 16, wherein the LLZO feedstock is a solid feedstock.~~

~~18. The method of Claim 16, wherein the LLZO feedstock is a liquid feedstock~~

~~19. The method of any one of Claims 16-18, wherein the dopant is selected from the group consisting of Al, B, Ga, Be, Fe, Zn, Ta, Nb, Tc, Ce, Ti, Sn, Mo, Ru, Hf, Mg, Sc, Mn, Ni, Cu, Co, Ir, Pt, Pd, and combinations thereof.~~

~~20. The method of any one of Claims 16-19, further comprising sintering the spheroidized LLZO powder.~~