Claims:

1. A phase-stabilized ammonium nitrate (PSAN) explosive comprising: a PSAN prill comprising:

ammonium nitrate;

a potassium salt, wherein the PSAN prill comprises from 0.5 mole percent (mol%) to 5 mol% potassium ions of the potassium salt based on the ammonium ions of the ammonium nitrate; and

an inorganic porosity enhancing agent;

and a fuel.

2. The PSAN explosive of claim 1, wherein the mol% of the potassium ions based on the ammonium ions is from 2 mol% to 5 mol%, 2 mol% to 4 mol%, 2.1 mol% to 4 mol%, or about 3 mol%.

3. The PSAN explosive of claim 1 or claim 2, wherein the fuel comprises a liquid fuel, including fuel oil, diesel oil, distillate, furnace oil, kerosene, gasoline, or naphtha; waxes including microcrystalline wax, paraffin wax, or slack wax; oils including paraffin oils, benzene, toluene, or xylene oils, asphaltic materials, polymeric oils, animal oils, or other mineral, hydrocarbon, or fatty oils; and mixtures thereof.

4. The PSAN explosive of any one of claims 1-3, wherein a weight ratio of the PSAN prill to fuel is 80:20 to 97:3, 85:15 to 96:4, 90:10 to 95:5, or 94:6.

5. The PSAN explosive of any one of claims 1-4, wherein the fuel is not an emulsion.

6. The PSAN explosive of any one of claims 1-5, wherein the inorganic porosity enhancing agent comprises an interfacial surface modifier, a pore former, or both.

7. The PSAN explosive of any one of claims 1-6, wherein the inorganic porosity enhancing agent comprises aluminum sulfate.

8. The PSAN explosive of any one of claims 1-7, wherein the concentration of the inorganic porosity enhancing agent in the prill is from 400 ppm to 4,000 ppm, from 400 ppm to 1,000 ppm, from 500 ppm to 900 ppm, from 600 ppm to 800 ppm, about 700 ppm, 2,000 ppm to 4,000 ppm, from 2,500 ppm to 3,900 ppm, from 3,000 ppm to 3,700 ppm, or about 3,500 ppm.

9. The PSAN explosive of any one of claims 1-8, wherein the potassium salt comprises at least one of potassium hydroxide, potassium nitrate, or potassium sulfate.

10. The PSAN explosive of any one of claims 1-9, wherein the PSAN prill has a bulk density less than 0.9 kg/L, including less than 0.84 kg/L.

11. The PSAN explosive of any one of claims 1-10, wherein the PSAN prill is explosive grade.

12. The PSAN explosive of any one of claims 1-11, wherein the PSAN prill has at least about 5.7% porosity.

13. The PSAN explosive of any one of claims 1-12, wherein the PSAN prill substantially lacks a 32 °C crystalline phase change.

14. The PSAN explosive of any one of claims 1-13, wherein the PSAN prill substantially lacks an 84 °C crystalline phase change.

15. The PSAN explosive of claim 13 or claim 14, wherein the presence of the 32 °C crystalline phase change or the 84 °C crystalline phase change is determined by thermal analysis or x-ray diffraction measurements.

16. The PSAN explosive of claim 15, wherein the thermal analysis comprises differential scanning calorimeter and thermogravimetric analyzer analysis.

17. The PSAN explosive of any one of claims 1-16, wherein upon thermal cycling the PSAN explosive 50 times, wherein one cycle comprises four hours at 15 °C followed by four hours at 45 °C, the thermal cycled PSAN explosive has an average crush strength greater than 0.4 kg, including from 0.4 kg to 2.0 kg, 0.5 kg to 1.5 kg, 0.6 kg to 1.0 kg, or 0.7 kg to 0.9 kg.

18. The PSAN explosive of any one of claims 1-17, wherein upon thermal cycling the PSAN explosive 20 times, wherein one cycle comprises four hours at 15 °C followed by four hours at 45 °C, an average crush strength of the thermal cycled PSAN explosive is greater than an average crush strength of non-thermal cycled control PSAN explosive.

19. The PSAN explosive of claim 18, wherein the average crush strength of the thermal cycled PSAN explosive is from 5% to 100%, 10% to 80%, 20% to 60%, or 25% to 40% greater than the average crush strength of the non-thermal cycled control PSAN explosive.

20. The PSAN explosive of any one of claims 1-19, wherein the shelf life of the PSAN explosive is at least two months, at least four months, or at least six months at an average daytime ambient temperature from about 30 °C to about 50 °C and an average nighttime temperature of about 10 °C to about 30 °C.

21. A method of increasing the hardness of a phase-stabilized ammonium nitrate (PSAN) explosive, the method comprising:

providing the PSAN explosive of any one of claims 1-20, and

thermal cycling the PSAN explosive 20 times or more.

22. The method of claim 21, wherein the average crush strength of the thermal cycled PSAN explosive is increased by at least 5% greater than the average crush strength of a non-thermal cycled control PSAN explosive,

including from 5% to 100%, 10% to 80%, 20% to 60%, or 25% to 40% greater than the average crush strength of a non-thermal cycled control PSAN explosive.

23. A method of preparing a phase-stabilized ammonium nitrate (PSAN) prill, the method comprising:

forming a PSAN solution comprising a potassium salt and ammonium nitrate; and crystallizing the PSAN solution to form a PSAN prill by dropping liquid droplets of

the PSAN solution within a prill tower, wherein a temperature limit for the PSAN prill at a bottom of the prill tower is at least 85 °C.

24. The method of claim 23, wherein the temperature limit for the PSAN prill at the bottom of the prill tower is at least 86 °C, at least 87 °C, at least 88 °C, at least 89 °C, or at least 90 °C.

25. The method of claim 23, wherein the temperature limit for the PSAN prill at the bottom of the prill tower is between 85 °C to 95 °C or 85 °C to 90 °C.

26. The method of any one of claims 23-25, further comprising:

combining a porosity enhancing agent with the PSAN solution.

27. The method of any one of claims 23-26, further comprising:

transferring the PSAN prill to a cooling mechanism.

28. The method of claim 27, wherein the cooling mechanism comprises a fluidized bed cooler.

29. The method of claim 27 or 28, wherein a temperature limit for the PSAN prill exiting the cooling mechanism is at least 35 °C, at least 36 °C, at least 37 °C, at least 38

°C, at least 39 °C, or at least 40 °C.

30. The method of claim 27 or 28, wherein a temperature limit for the PSAN prill exiting the cooling mechanism is between 30 °C to 40 °C, between 32 °C to 40 °C, or between 35 °C to 40 °C.

31. The method of any one of claims 23-30, wherein a prilling rate is greater than 35 T/hr, greater than 36 T/hr, greater than 37 T/hr, greater than 38 T/hr, greater than 39 T/hr, or greater than 40 T/hr.

32. The method of any one of claims 23-30, wherein a prilling rate is from 35 T/hr to 42 T/hr or from 38 T/hr to 41 T/hr.

33. The method of any one of claims 23-30, wherein a prilling rate is at least 10%, at least 20%, at least 30%, at least 40%, or at least 50% higher than prilling rates obtained with conventional LOAN prill solutions.

34. The method of any one of claims 23-30, wherein a prilling rate is from 10% to 60% higher, from 10% to 50% higher, from 10% to 40% higher, from 10% to 30% higher, or from 10% to 20% higher than prilling rates obtained with conventional LOAN prill solutions.

35. The method of any one of claims 31-34, wherein ambient temperature is from 35 °C to 45 °C.