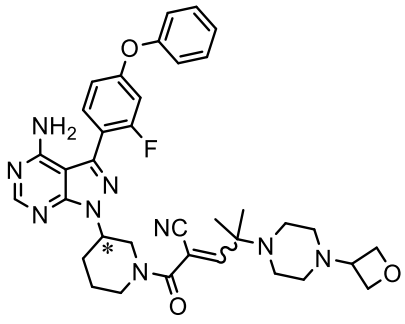
What is claimed is:

1. Crystalline Form A of Compound (**I**):



(**I**),

wherein C* is a stereochemical center characterized by an X-ray powder diffractogram having a signal at at least three two-theta values chosen from 5.6 ± 0.2, 12.7 ± 0.2, 16.5 ± 0.2, 17.0 ± 0.2, 17.7 ± 0.2, 18.7 ± 0.2, 19.2 ± 0.2, 20.7 ± 0.2, 22.2 ± 0.2, and 24.4 ± 0.2.

2. Crystalline Form A according to claim 1, further characterized by an X-ray powder diffractogram substantially similar to that in FIG. 1.

3. Crystalline Form A according to claim 1 or 2, further characterized by a DSC thermogram having a peak endotherm (melting temperature) at 146 °C ± 5% to 147 °C ± 5%.

4. Crystalline Form A according to any one of claims 1-3, further characterized by a DSC thermogram showing onset of melting at 140.6 °C ± 5% to 141.2 °C ± 5%.

5. Crystalline Form A according to any one of claims 1-4, further characterized by a mass loss of less than 1.0 wt. % between 25 °C and 200 °C by thermogravimetric analysis.

6. Crystalline Form A according to any one of claims 1-5, further characterized by a water content of less than 1% upon storage at 95% relative humidity (RH).

7. Crystalline Form A according to any one of claims 1-6, wherein at least 95% of Compound (**I**) is the (E) isomer.

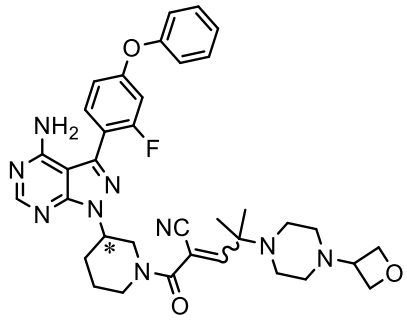
8. Crystalline Form A of Compound (**I**) according to any one of claims 1-7, prepared by a process comprising:

adding isopropyl acetate to amorphous (R)-2-[3-[4-amino-3-(2-fluoro-4-phenoxy-phenyl)pyrazolo[3,4-d]pyrimidin-1-yl]piperidine-1-carbonyl]-4-methyl-4-[4-(oxetan-3-yl)piperazin-1-yl]pent-2-enenitrile to form a solution;

agitating the solution to form a precipitate; and

isolating crystalline Form A by filtration.

9. Crystalline Form B of Compound (**I**):



(**I**),

wherein C* is a stereochemical center, characterized by an X-ray powder diffractogram having a signal at at least three two-theta values chosen from 10.8 ± 0.2, 15.3 ± 0.2, 16.3 ± 0.2, 17.9 ± 0.2, 18.4 ± 0.2, 18.7 ± 0.2, 22.0 ± 0.2, and 22.9 ± 0.2.

10. Crystalline Form B according to claim 9, wherein at least >99% of Compound (**I**) is the (E)-isomer.

11. Crystalline Form B according to claim 9 or 10, wherein 95% to 99% of Compound (**I**) is the (E)-isomer.

12. Crystalline Form B according to any one of claims 9-11, further characterized by an X-ray powder diffractogram substantially similar to that in FIG. 4B.

13. Crystalline Form B according to claim 9 or 11, further characterized by an X-ray powder diffractogram substantially similar to that in FIG. 4A.

14. Crystalline Form B according to any one of claims 9-12, further characterized by a DSC thermogram having a peak endotherm (melting temperature) at 144 °C ± 5% to 146 °C ± 5%.

15. Crystalline Form B according to any one of claims 9-12 or 14, further characterized by a DSC thermogram showing onset of melting at 139.3 °C ± 5%.

16. Crystalline Form B according to any one of claims 9, 11, or 13, further characterized by a DSC thermogram having a peak endotherm (melting temperature) at 141 °C ± 5% to 142 °C ± 5%.

17. Crystalline Form B according to any one of claims 9, 11, 13, or 16, further characterized by a DSC thermogram showing onset of melting at 131.8 °C ± 5% to 132.4 °C ± 5%.

18. Crystalline Form B according to any one of claims 9-17, further characterized by a water content of less than 1.3% upon storage at 95% relative humidity (RH).

19. Crystalline Form B of Compound (**I**) according to any one of claims 9-18, prepared by a process comprising:

adding ethyl acetate to amorphous (R)-2-[3-[4-amino-3-(2-fluoro-4-phenoxy-phenyl)pyrazolo[3,4-d]pyrimidin-1-yl]piperidine-1-carbonyl]-4-methyl-4-[4-(oxetan-3-yl)piperazin-1-yl]pent-2-enenitrile to form a solution;

seeding the solution with sodium chloride and stirring the solution to obtain a suspension;

isolating crystalline Form B by filtration of the suspension.

20. Crystalline Form B of Compound (**I**) according to any one of claims 9-18, prepared by a process comprising:

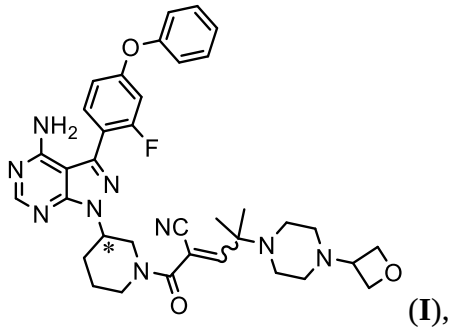
adding ethanol to crystalline Form C of (R)-2-[3-[4-amino-3-(2-fluoro-4-phenoxy-phenyl)pyrazolo[3,4-d]pyrimidin-1-yl]piperidine-1-carbonyl]-4-methyl-4-[4-(oxetan-3-

yl)piperazin-1-yl]pent-2-enenitrile as defined in any one of claims 21-29 to form a solution or a slurry;

seeding the solution or the slurry with seed crystals of crystalline Form B of Compound (**I**); and

isolating crystalline Form B of Compound (**I**) by filtration.

21. Crystalline Form C of Compound (**I**):



(**I**),

wherein C* is a stereochemical center, characterized by an X-ray powder diffractogram having a signal at at least three two-theta values chosen from 9.8 ± 0.2, 10.2 ± 0.2, 15.6 ± 0.2, 16.6 ± 0.2, 18.6 ± 0.2, 18.9 ± 0.2, 19.6 ± 0.2, and 21.6 ± 0.2.

22. Crystalline Form C according to claim 21, further characterized by an X-ray powder diffractogram substantially similar to that in FIG. 7.

23. Crystalline Form C according to claim 21 or 22, further characterized by a DSC thermogram having a peak endotherm (melting temperature) at 118.5 °C ± 5% to 119 °C ± 5%, wherein the DSC scanning rate is 15 °C/min.

24. Crystalline Form C according to any one of claims 21-23, further characterized by a DSC thermogram showing onset of melting at 115.6 °C ± 5% to 116 °C ± 5%, wherein the DSC scanning rate is 15 °C/min.

25. Crystalline Form C according to any one of claims 21-24, further characterized by a DSC thermogram having a peak endotherm (melting temperature) at 120.5 °C ± 5% to 121 °C ± 5%, wherein the DSC scanning rate is 10 °C/min.

26. Crystalline Form C according to any one of claims 21-25, further characterized by a DSC thermogram showing onset of melting at 118 °C ± 5% to 118.5 °C ± 5%, wherein the DSC scanning rate is 10 °C/min.

27. Crystalline Form C according to any one of claims 21-26, wherein at least 95% of Compound (**I**) is the (E) isomer.

28. Crystalline Form C according to any one of claims 21-27, further characterized by a P-1 space group.

29. Crystalline Form C according to any one of claims 21-28, further characterized by the following unit cell dimensions at 200(2) K:

a = 10.6741 Å α = 93.654°

b = 12.7684 Å β= 104.400°

c = 14.5287 Å γ = 105.476°.

30. Crystalline Form C of Compound (**I**) according to any one of claims 21-29, prepared by a process comprising:

adding acetonitrile to amorphous (R)-2-[3-[4-amino-3-(2-fluoro-4-phenoxy-phenyl)pyrazolo[3,4-d]pyrimidin-1-yl]piperidine-1-carbonyl]-4-methyl-4-[4-(oxetan-3-yl)piperazin-1-yl]pent-2-enenitrile to form a solution;

seeding the solution with crystalline Form B of Compound (**I**) as defined in any one of claims 9-18 to form a mixture and stirring the mixture to obtain a slurry; and

isolating crystalline Form C by filtering the slurry.

31. A pharmaceutical composition comprising:

at least one crystalline form of Compound (**I**) chosen from the crystalline form of any one of claims 1-30; and

at least one pharmaceutically acceptable excipient.

32. The pharmaceutical composition according to claim 31, wherein the pharmaceutical composition is in the form of a solid oral composition.

33. The pharmaceutical composition according to claim 31 or 32, wherein the pharmaceutical composition is in the form of a tablet or a capsule.

34. Use of at least one crystalline form chosen from the crystalline forms according to any one of claims 1 to 30 in the manufacture of a medicament for inhibiting Bruton's tyrosine kinase (BTK) in a mammal in need of said BTK inhibition.

35. Use of at least one crystalline form chosen from the crystalline forms according to any one of claims 1 to 30 in the manufacture of a medicament for treating a disease mediated by Bruton's tyrosine kinase (BTK) in a mammal in need thereof.

36. Use of at least one crystalline form chosen from the crystalline forms according to any one of claims 1 to 30 in the manufacture of a medicament for treating at least one of pemphigus vulgaris, pemphigus foliaceus, asthma, and dermatitis in a mammal in need thereof.

37. Use of at least one crystalline form chosen from the crystalline forms according to any one of claims 1 to 30 in the manufacture of a medicament for treating immune thrombocytopenia in a mammal in need thereof.

38. The use of any one of claims 34-37, wherein the mammal is a human.