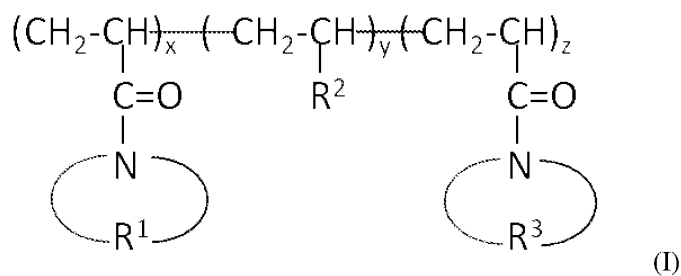


CLAIMS

1. A copolymer having General Formula (I):



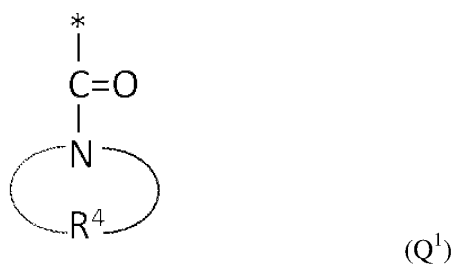
in which:

R^1 and R^3 are each independently chosen from divalent $\text{C}_4\text{-C}_7$ aliphatic groups and divalent $\text{C}_4\text{-C}_7$ heteroaliphatic groups, optionally substituted with one or more $\text{C}_1\text{-C}_6$ aliphatic groups, heteroatoms independently chosen from O, N, and S, or combination thereof, where:

the divalent $\text{C}_4\text{-C}_7$ heteroaliphatic groups of R^1 and R^3 comprise one or two heteroatoms independently chosen from O, N, and S, and

the maximum number of heteroatoms in R^1 or R^3 is two;

R^2 is chosen from Q^1 and Q^2 :



in which:

R^4 and R^5 are each independently chosen from divalent C_4-C_7 aliphatic groups and divalent C_4-C_7 heteroaliphatic groups, optionally substituted with one or more C_1-C_6 aliphatic groups, heteroatoms independently chosen from O, N, and S, or combination thereof, where:

the divalent C_4-C_7 heteroaliphatic groups of R^4 and R^5 comprise one or two heteroatoms independently chosen from O, N, and S, and

the maximum number of heteroatoms in R^4 or R^5 is two;

x is a molar fraction range chosen from 0.1 to 0.9;

y is a molar fraction range chosen from 0.1 to 0.9; and

z is a molar fraction range chosen from 0 to 0.8, where the summation of x, y, and z equals 1.

2. The copolymer of claim 1, where R^1 is chosen from divalent C_4-C_6 linear aliphatic groups and divalent C_4-C_6 linear heteroaliphatic groups.
3. The copolymer of claim 1 or claim 2, where R^1 is chosen from divalent C_4-C_6 linear heteroaliphatic groups.
4. The copolymer of any of the preceding claims, where R^4 and R^5 are each independently chosen from divalent C_4-C_6 linear aliphatic groups and divalent C_4-C_6 linear heteroaliphatic groups.
5. The copolymer of any of the preceding claims, where R^4 and R^5 are each independently chosen from divalent C_4-C_6 linear aliphatic groups.

6. The copolymer of any of the preceding claims, where R^4 and R^5 are substituted with one or more C_1 - C_3 aliphatic groups.
7. The copolymer of any of the preceding claims, where:
 R^4 and R^5 are each independently chosen from divalent C_4 - C_6 linear aliphatic groups,
and
 R^4 and R^5 are substituted with one or more C_1 - C_3 aliphatic groups.
8. The copolymer of any of the preceding claims, where R^4 and R^5 are substituted with heteroatoms independently chosen from O, N, and S.
9. The copolymer of any of claims 1-4, where:
 R^2 is Q^1 , and
 R^4 is chosen from divalent C_4 - C_6 linear aliphatic groups and divalent C_4 - C_6 linear heteroaliphatic groups.
10. The copolymer of any of claims 1-4, where:
 R^2 is Q^2 , and
 R^5 is chosen from divalent C_4 - C_6 linear aliphatic groups and divalent C_4 - C_6 linear heteroaliphatic groups.
11. The copolymer of any of claims 1-4, where:
 R^2 is Q^1 , and
 R^4 is chosen from divalent C_4 - C_6 linear aliphatic groups.

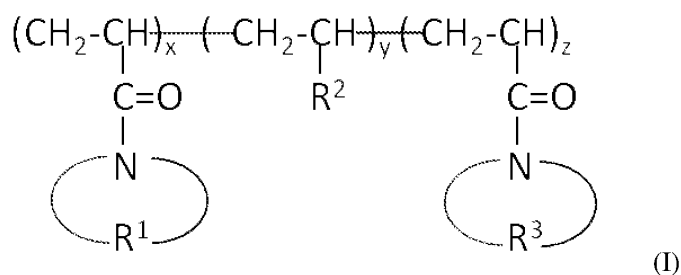
12. The copolymer of any of claims 1-4, where:
 R^2 is Q^2 , and
 R^5 is chosen from divalent C_4-C_6 linear aliphatic groups.
13. The copolymer of any of claims 1-4, where:
 R^2 is Q^2 ,
 R^5 is chosen from divalent C_4-C_6 linear aliphatic groups and divalent C_4-C_6 linear heteroaliphatic groups, and
 R^5 is substituted with one heteroatom independently chosen from O, N, and S.
14. The copolymer of any of the preceding claims, where R^3 is chosen from divalent C_4-C_6 linear aliphatic groups and divalent C_4-C_6 linear heteroaliphatic groups.
15. The copolymer of claim 1, where:
 R^1 is chosen from divalent C_4-C_6 linear aliphatic groups and divalent C_4-C_6 linear heteroaliphatic groups,
 R^3 is chosen from divalent C_4-C_6 linear aliphatic groups and divalent C_4-C_6 linear heteroaliphatic groups,
 R^4 and R^5 are each independently chosen from divalent C_4-C_6 linear aliphatic groups and divalent C_4-C_6 linear heteroaliphatic groups,
x is a molar fraction range of from 0.25 to 0.75,
y is a molar fraction range of from 0.25 to 0.75,
z is a molar fraction range of from 0.25 to 0.5.
16. The copolymer of any of the preceding claims, where:
x is a molar fraction range of from 0.25 to 0.75,

y is a molar fraction range of from 0.25 to 0.75, and

z is a molar fraction range of from 0.25 to 0.5.

17. The copolymer of any of the preceding claims, where z is a molar fraction of greater than 0.
18. The copolymer of any of the preceding claims, where x and y are equimolar fractions.
19. The copolymer of any of the preceding claims, where x, y, and z are equimolar fractions.
20. The copolymer of any of the preceding claims, where the viscosity average molecular weight of the copolymer is in the range of from 500 g/mol to 1,000,000 g/mol.
21. The copolymer of any of the preceding claims, where the viscosity average molecular weight of the copolymer is in the range of from 500 g/mol to 20,000 g/mol.
22. A method for inhibiting formation of clathrate hydrates in a fluid capable of forming the clathrate hydrates, the method comprising:

contacting the fluid with at least one copolymer of General Formula (I) under conditions suitable for forming the clathrate hydrates:



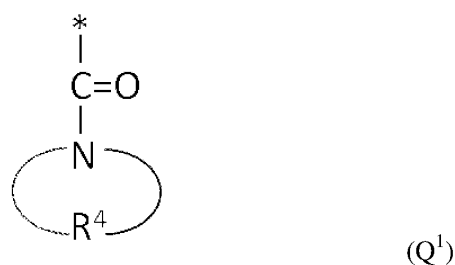
in which:

R^1 and R^3 are each independently chosen from divalent C_4 - C_7 aliphatic groups and divalent C_4 - C_7 heteroaliphatic groups, optionally substituted with one or more C_1 - C_6 aliphatic groups, heteroatoms independently chosen from O, N, and S, or combination thereof, where:

the divalent C_4 - C_7 heteroaliphatic groups of R^1 and R^3 comprise one or two heteroatoms independently chosen from O, N, and S, and

the maximum number of heteroatoms in R^1 or R^3 is two;

R^2 is chosen from Q^1 and Q^2 :



in which:

R^4 and R^5 are each independently chosen from divalent C_4 - C_7 aliphatic groups and divalent C_4 - C_7 heteroaliphatic groups, optionally substituted with one or more C_1 - C_6 aliphatic groups, heteroatoms independently chosen from O, N, and S, or combination thereof, where:

the divalent C_4 - C_7 heteroaliphatic groups of R^4 and R^5 comprise one or two heteroatoms independently chosen from O, N, and S, and

the maximum number of heteroatoms in R^4 or R^5 is two;

x is a molar fraction range chosen from 0.1 to 0.9;

y is a molar fraction range chosen from 0.1 to 0.9; and

z is a molar fraction range chosen from 0 to 0.8, where the summation of x, y, and z equals 1.

23. The method of claim 22, where the fluid comprises water host molecules and natural gas guest molecules chosen from methane, ethane, propane, butane, pentane, carbon dioxide, hydrogen sulfide, nitrogen, or combination thereof.

24. The method of claim 22 or claim 23, where the fluid comprises acid gas guest molecules.

25. The method of any of claims 22-24, where the fluid comprises natural gas guest molecules chosen from carbon dioxide, hydrogen sulfide, nitrogen, or combination thereof.

26. The method of any of claims 22-25, where the fluid comprises methane, ethane, propane, butane, carbon dioxide, hydrogen sulfide, and nitrogen gas guest molecules.

27. The method of any of claims 22-26, where:

the clathrate hydrates comprise SI clathrate hydrates, SII clathrate hydrates, SH clathrate hydrates, or combination thereof, and

the contacting inhibits formation of the SI clathrate hydrates, the SII clathrate hydrates, the SH clathrate hydrates, or the combination thereof.

28. The method of any of claims 22-27, where the contacting inhibits the formation of the clathrate hydrates at a first subcooling temperature of from 0 °C to 4.0 °C.

29. The method of any of claims 22-28, where the contacting inhibits the formation of the clathrate hydrates at a second subcooling temperature of from 4.0 °C to 10.0 °C.

30. The method of any of claims 22-29, where the contacting inhibits the formation of the clathrate hydrates in a pressure range of from 40 bars to 200 bars.

31. The method of any of claims 22-30, where the contacting inhibits the formation of the clathrate hydrates in a pressure range of from 70 bars to 100 bars.

32. The method of any of claims 22-31, where the fluid is contacted with a composition comprising the at least one copolymer of Formula (I) and at least one of a corrosion inhibitor or solvent.

33. The method of any of claims 22-32, where the fluid is a brine.

34. The method of any of claims 22-33, where:

R^1 is chosen from divalent linear C_4 - C_6 aliphatic groups and divalent linear C_4 - C_6 heteroaliphatic groups,

R^2 is Q^2 , and

R^5 is chosen from divalent C_4 - C_6 linear aliphatic groups and divalent C_4 - C_6 linear heteroaliphatic groups.

35. The method of any of claims 22-33, where:

R^1 is chosen from divalent linear C_4 - C_6 aliphatic groups and divalent linear C_4 - C_6 heteroaliphatic groups,

R^2 is Q^1 , and

R^4 is chosen from divalent C_4 - C_5 linear aliphatic groups and divalent C_4 - C_5 linear heteroaliphatic groups.

36. The method of any of claims 22-33, where:
- R^1 is chosen from divalent linear C_4-C_6 aliphatic groups and divalent linear C_4-C_6 heteroaliphatic groups,
- R^4 and R^5 are each independently chosen from divalent C_4-C_6 linear aliphatic groups and divalent C_4-C_6 linear heteroaliphatic groups,
- x is a molar fraction of 0.8, and
- y is a molar fraction of 0.2.
37. The method of any of claims 22-36, where R^1 is chosen from divalent C_4-C_5 linear aliphatic groups and divalent C_4-C_5 linear heteroaliphatic groups.
38. The method of any of claims 22-33, where R^4 and R^5 are each independently chosen from divalent C_4-C_6 linear aliphatic groups and divalent C_4-C_6 linear heteroaliphatic groups.
39. The method of any of claims 22-33, where:
- R^1 is chosen from divalent C_4-C_6 linear aliphatic groups and divalent C_4-C_6 linear heteroaliphatic groups,
- R^3 is chosen from divalent C_4-C_6 linear aliphatic groups and divalent C_4-C_6 linear heteroaliphatic groups,
- R^4 and R^5 are each independently chosen from divalent C_4-C_6 linear aliphatic groups and divalent C_4-C_6 linear heteroaliphatic groups,
- x is a molar fraction range of from 0.25 to 0.75,
- y is a molar fraction range of from 0.25 to 0.75, and
- z is a molar fraction greater than 0.
40. The method of any of claims 22-39, where x and y are equimolar fractions.

41. The method of any of claims 22-40, where x, y, and z are equimolar fractions.
42. The method of any of claims 22-41, where the viscosity average molecular weight of the at least one copolymer is in the range of from 500 g/mol to 20,000 g/mol.
43. The method of any of claims 22-42, where the fluid is contacted with the at least one copolymer at a tie-in platform.
44. The method of any of claims 22-43, where the fluid is flowing in a pipeline.