

CLAIMS

WHAT IS CLAIMED IS:

1. A wellbore tool system, comprising:
a conveyance vehicle extendable to a downhole location in a wellbore;
a wellbore tool coupled to the conveyance vehicle and including first and second members separated by a clearance gap; and
a sealing assembly disposed between the first and second members, the sealing assembly including an energizing element constructed of a thermoplastic material arranged in a lattice structure wherein the lattice structure is movable from a resting configuration to an energized configuration in sealing engagement with the first and second members by the application of pressure to the energizing element, wherein the sealing assembly further comprises a pair of backup rings on opposing sides of the energizing element.
2. The wellbore tool system according to claim 1, wherein the energizing element further comprises an outer cover disposed therearound, the outer cover constructed of an elastomeric material, and optionally wherein the energizing element exhibits an outer geometry and a bulk elasticity within a predetermined tolerance of the elastomeric material arranged in the outer geometry of the energizing element.
3. The wellbore tool system according to claim 1, wherein the energizing element is devoid of an outer covering such that the thermoplastic material defines an outer geometry of the energizing element.
4. The wellbore tool system according to any one of the preceding claims, wherein
 - (i) the lattice structure is arranged in a honeycomb structure having walls defining hexagonal voids therebetween;
 - (ii) the lattice structure includes a thermoplastic substrate with a plurality filler elements dispersed therein, the filler elements collapsible upon an application of a force applied by a pressure sufficient for energizing the sealing assembly; and/or
 - (iii) the lattice structure includes a plurality of voids defined therein, wherein a first portion of the voids is filled with a filler material and wherein a second portion of the voids

is devoid of the filler material.

~~5. The wellbore tool system according to any one of the preceding claims, wherein the sealing assembly further comprises a pair of backup rings on opposing sides of the energizing element.~~

65. The wellbore tool system according to any one of the preceding claims, wherein the energizing element is substantially ring shaped with a circular cross-section.

76. A method of establishing a seal between first and second members in a wellbore, the method comprising:

determining ~~the~~ bulk characteristics of an energizing element to form the seal, the bulk characteristics including at least an outer geometry and an elasticity;

constructing the energizing element to include a lattice structure formed from a thermoplastic material to exhibit the elasticity within a predetermined tolerance;

deploying the energizing element to a downhole location within the wellbore; ~~and~~

applying a pressure downhole to create a pressure differential, wherein the pressure differential is elastically deforming the energizing element and thereby sealingly ~~engaging~~engage the first and second members, and

assembling the energizing element into a sealing assembly including at least one backup ring in operative engagement with the energizing element.

87. The method according to claim 76, wherein constructing the energizing element further comprises forming an outer cover around an exterior of the lattice structure, the outer cover constructed of a polymeric material or an elastomeric material.

98. The method according to claim 76 or claim 87, wherein constructing the energizing element includes an additive manufacturing process to form the lattice structure.

~~109.~~ The method according to any one of claims ~~76~~ through ~~98~~, wherein constructing the energizing element includes at least one of the group consisting of dispersing a plurality of collapsible filler elements in a thermoplastic substrate, wherein the filler elements are collapsible upon applying the pressure differential, and dispersing a plurality of dissolvable filler elements in a thermoplastic substrate, and dissolving the filler elements to create voids in the substrate to thereby form the lattice structure.

~~110.~~ The method according to any one of claims ~~76~~ through ~~109~~, wherein constructing the energizing element includes forming a plurality of voids in the lattice structure, inserting a filler material into a first portion of the plurality of voids and maintaining a second portion of the voids devoid of the filler material

~~12. The method according to any one of claims 7 through 11, further comprising assembling the energizing element into a sealing assembly including at least one backup ring in operative engagement with the energizing element.~~

~~11.~~ The method according to any one of claims ~~76~~ through ~~1210~~, further comprising removing the pressure to return the energizing element to a resting configuration in the wellbore.

~~12.~~ An energizing element for use in a wellbore tool, the energizing element comprising;

a lattice structure formed of a thermoplastic material, the lattice structure arranged to include a plurality of voids therein devoid of filler material such that the lattice structure exhibits a bulk elasticity within a predetermined tolerance of a targeted elastomeric material, wherein the energizing element is configured to form a seal in the wellbore tool;
and

an outer covering disposed around an outer geometry of the lattice structure, the outer covering constructed of at least one of the group consisting of the thermoplastic material of the lattice structure, a different thermoplastic material, the targeted elastomeric material, a different elastomeric and a polymeric material.

~~13.~~ The energizing element according to claim ~~12~~, wherein the lattice structure is

arranged in a honeycomb structure having walls defining hexagonal voids therebetween, and optionally wherein the energizing element is constructed as an o-ring with a generally circular cross section._