What is claimed:

1. A microfluidic device comprising:

an enclosure comprising:

a substrate;

a flow region located within the enclosure; and

at least one in situ-generated isolation structure disposed on the substrate, wherein the at least one in situ-generated structure comprises a solidified polymer network.

2. The microfluidic device of claim 1, wherein the solidified polymer network comprises a photoinitiated polymer.

3. The microfluidic device of claim 1, wherein the microfluidic device further comprises at least one sequestration pen, that comprises an isolation region and a connection region,

the connection region having a proximal opening to the flow region and a distal opening to the isolation region.

4. The microfluidic device of claim 1, wherein the flow region comprises a microfluidic channel; and

wherein the microfluidic device comprises a plurality of sequestration pens.

5. The microfluidic device of claim 1, wherein the at least one in situ-generated isolation structure is configured to retain one or more of a plurality of micro-objects.

6. The microfluidic device of claim 1, wherein the at least one in situ-generated isolation structure comprises a plurality of in situ-generated isolation modules disposed in the flow region, wherein the plurality of in situ-generated isolation modules are configured to substantially restrict passage of micro-objects into, out of, and/or through the at least one in situ generated isolation structure in a size dependent manner.

7. The microfluidic device of claim 6, wherein each in situ-generated isolation module of the plurality is spaced apart from any other in situ-generated isolation module of the plurality such that micro-objects having a diameter of 5 microns or greater are substantially

prevented from passing into, out of, and/or through the at least one in situ-generated isolation structure.

8. The microfluidic device of any one of claims 1-7, wherein the microfluidic device further comprises a plurality of in situ-generated isolation structures.

9. A microfluidic device comprising:

an enclosure comprising:

a flow region comprising a microfluidic channel;

a sequestration pen, wherein the sequestration pen opens off of the microfluidic channel; and

an in situ-generated isolation structure comprising an in situ-generated barrier disposed on the substrate, the in situ-generated barrier comprising a solidified polymer network.

10. The microfluidic device of claim 9, wherein the in situ-generated barrier at least partially blocks the microfluidic channel and/or the sequestration pen.

11. The microfluidic device of claim 9, wherein the in situ-generated barrier is disposed within a connection region of the sequestration pen.

12. The microfluidic device of claim 9, wherein the in situ-generated barrier is disposed in the microfluidic channel and located adjacent to one edge of a proximal opening of the sequestration pen.

13. The microfluidic device of claim 1, wherein the solidified polymer network comprises a synthetic polymer, a modified synthetic polymer, or a biological polymer.

14. The microfluidic device of claim 1, wherein the solidified polymer network comprises a modified polyethylene glycol polymer.

15. The microfluidic device of claim 1, wherein the solidified polymer network is susceptible to degradation by hydrolysis, proteolysis, osmotic change, temperature change or optical illumination.

16. The microfluidic device of claim 1, wherein the solidified polymer network is susceptible to displacement by increased fluidic flow.

17. The microfluidic device of claim 1, wherein at least one inner surface of the enclosure comprises a conditioned surface.

18. The microfluidic device of claim 1, wherein the substrate is configured to generate dielectrophoresis (DEP) forces within the enclosure.

19. A method of isolating a micro-object in a microfluidic device, comprising:

introducing a first fluidic medium comprising a plurality of micro-objects into an enclosure of the microfluidic device, the enclosure comprising a substrate and a flow region;

introducing a solution comprising a flowable polymer into the enclosure;

activating solidification of the flowable polymer in at least one selected area of the flow region, thereby forming an in situ-generated isolation structure; and

isolating at least one of the plurality of micro-objects with the in situ-generated isolation structure.

20. The method of claim 19, wherein the activating solidification of the flowable polymer comprises optically illuminating the at least one selected area of the flow region, and thereby initiating polymerization of the flowable polymer to form a polymer network.

21. The method of claim 19, wherein the introducing the solution comprising a flowable polymer further comprises introducing a photoactivatable polymerization initiator.

22. The method of claim 19, further comprising processing a remainder of the plurality of micro-objects or exporting a remainder of the plurality of micro-objects from the microfluidic device.

23. The method of claim 19, further comprising:

reducing or removing the in situ-generated isolation structure by:

increasing flow of the first fluidic medium through the flow region;

introducing a hydrolytic agent into the flow region;

introducing a proteolytic agent into the flow region;

introducing a different fluidic medium into the flow region that increases/decreases an osmolality within the flow region;

changing a temperature of the in situ-generated isolation structure; or

optically illuminating the in situ-generated isolation structure; and

thereby releasing the at least one micro-object from the in situ-generated isolation structure.

24. The method of claim 23, further comprising exporting the at least one released micro-object from the microfluidic device.

25. The method of claim 19, wherein the enclosure of the microfluidic device further comprises at least one sequestration pen comprising an isolation region and a connection region, the connection region having a proximal opening to the flow region and a distal opening to the isolation region.

26. The method of claim 25, wherein the activating solidification forms an in situ-generated isolation structure comprising an in situ-generated barrier inside the at least one sequestration pen.

27. The method of claim 19, wherein activating solidification of the flowable polymer forms an in situ-generated isolation structure comprising an in situ-generated barrier in the microfluidic channel.

28. The method of any one of claims 19-27, wherein the flowable polymer comprises a synthetic polymer, a modified synthetic polymer, or a biological polymer.

29. A kit comprising:

a microfluidic device comprising an enclosure comprising:

a substrate;

a flow region located within the enclosure; and

at least one in situ-generated isolation structure disposed on the substrate, wherein the at least one in situ-generated structure comprises a solidified polymer network; and

a flowable polymer solution, wherein the polymer is capable of polymerization and/or thermally induced gelling.

30. The kit of claim 29, further comprising a photoactivatable polymerization initiator.

31. The kit of claim 29, wherein the flowable polymer comprises a synthetic polymer, a modified synthetic polymer, or a biological polymer.

32. The kit of claim 29, wherein the flowable polymer comprises at least one of a polyethylene glycol, modified polyethylene glycol, polylactic acid (PLA), modified polylactic acid, polyglycolic acid (PGA), modified polyglycolic acid, polyacrylamide (PAM), modified polyacryla mide, poly-N-isopropylacrylamide (PNIPAm), modified poly-N-isopropylacrylamide, polyvinyl alcohol (PVA), modified polyvinyl alcohol, polyacrylic acid (PAA), modified polyacrylic acid, polycaprolactone (PCL), modified polycaprolactone, fibronectin, modified fibronectin, collagen, modified collagen, laminin, modified laminin, polysaccharide, modified polysaccharide, or a co-polymer in any combination.

33. The kit of any one of claims 29-31 or 32, further comprising a reagent configured to covalently modify at least one internal surface of the microfluidic device, wherein the reagent provides an alkyl-terminated, a fluoroalkyl terminated, a PEG- terminated, a dextran terminated, or a positively charged or negatively charged terminated moiety to the covalently modified surface.