

substantially transparent polymer layer, the second substantially transparent polymer layer having a center portion that is aligned with the center portion of the first substantially transparent polymer layer, wherein the second substantially transparent polymer layer is affixed to the second surface of the first substantially transparent polymer layer and does not extend beyond the two-dimensional shape of the first substantially transparent polymer layer; and (f) a magnetic, substantially non-transparent layer that encloses the center portion of the first substantially transparent polymer layer between the substantially non-transparent polymer layer and the center portion of the substantially transparent polymer layer, wherein the magnetic, substantially non-transparent layer is affixed between the first and the second substantially transparent polymer layers. In some embodiments, the microcarrier further comprises an orientation indicator for orienting the analog code of the substantially non-transparent polymer layer. In some embodiments, the orientation indicator comprises an asymmetry of the magnetic, substantially non-transparent layer. In some embodiments, the magnetic, substantially non-transparent layer comprises nickel. In some embodiments, the magnetic, substantially non-transparent layer is between about 50 nm and about 10 μm in thickness. In some embodiments, the magnetic, substantially non-transparent layer is about 0.1 μm in thickness. In some embodiments, the two-dimensional shape of the substantially non-transparent polymer layer comprises a gear shape comprising a plurality of gear teeth, and wherein the analog code is represented by one or more embodiments selected from the group consisting of the height of one or more gear teeth of the plurality, the width of one or more gear teeth of the plurality, the number of gear teeth in the plurality, and the arrangement of one or more gear teeth within the plurality. In some embodiments, the plurality of gear teeth comprises one or more gear teeth that are between about 1 μm and about 10 μm wide. In some embodiments, the plurality of gear teeth comprises one or more gear teeth that are between about 1 μm and about 10 μm tall. In some embodiments, the plurality of gear teeth comprises two or more gear teeth that are spaced between about 1 μm and about 10 μm apart. In some embodiments, the microcarrier further comprises (g) one or more columns projecting from the first surface of the first substantially transparent polymer layer, wherein the one or more columns are not within the center portion of the first substantially transparent polymer layer; and/or (h) one or more columns projecting from the second surface of the first substantially transparent polymer layer or a surface of the second substantially transparent polymer layer that is not affixed to the first substantially transparent polymer layer, wherein the one or more columns are not within the center portions of the first or the second substantially transparent polymer layer. In some

tall. In some embodiments, the one or more columns are between about 1 μm and about 10 μm in diameter. In some embodiments, the microcarrier further comprises (d) a magnetic layer comprising a magnetic material affixed to the second surface of the substantially non-transparent polymer layer, wherein the magnetic layer does not extend beyond the center portion of the substantially non-transparent polymer layer, and wherein the capture agent is coupled to at least the first surface of the substantially non-transparent polymer layer. In some embodiments, the microcarrier further comprises (e) a second substantially non-transparent polymer layer aligned with the first substantially non-transparent polymer layer, wherein the second substantially non-transparent polymer layer is affixed to the second surface of the first substantially transparent polymer layer and does not extend beyond the outline of the first substantially transparent polymer layer, and wherein the magnetic layer is affixed between the first and the second substantially transparent polymer layers. In some embodiments, the magnetic material comprises nickel. In some embodiments, the microcarrier further comprises an orientation indicator for orienting the analog code of the substantially non-transparent polymer layer. In some embodiments, the orientation indicator comprises an asymmetry of the outline of the substantially non-transparent polymer layer. In some embodiments, the outline of the substantially non-transparent polymer layer comprises a two-dimensional gear shape comprising a plurality of gear teeth, and wherein the analog code is represented by one or more embodiments selected from the group consisting of the height of one or more gear teeth of the plurality, the width of one or more gear teeth of the plurality, the number of gear teeth in the plurality, and the arrangement of one or more gear teeth within the plurality. In some embodiments, the plurality of gear teeth comprises one or more gear teeth that are between about 1 μm and about 10 μm wide. In some embodiments, the plurality of gear teeth comprises one or more gear teeth that are between about 1 μm and about 10 μm tall. In some embodiments, the plurality of gear teeth comprises two or more gear teeth that are spaced between about 1 μm and about 10 μm apart. In some embodiments, the microcarrier is a substantially circular disc. In some embodiments, the center portion of the first substantially non-transparent polymer layer comprises between about 5% and about 90% of the surface area of the first substantially non-transparent polymer layer. In some embodiments, the center portion of the first substantially non-transparent polymer layer comprises about 25% of the surface area of the first substantially non-transparent polymer layer. In some embodiments, the microcarrier is less than about 200 μm in diameter. In some embodiments, the microcarrier is about 60 μm in diameter. In some embodiments, the microcarrier is less than about 50 μm in thickness.

[0016] In some embodiments, the magnetic, substantially non-transparent layer is etched by wet etching. In some embodiments, the magnetic, substantially non-transparent layer comprises nickel. In some embodiments, the magnetic, substantially non-transparent layer is between about 50 nm and about 10 μm in thickness. In some embodiments, the magnetic, substantially non-transparent layer is less than about 0.1 μm in thickness. In some embodiments, the magnetic, substantially non-transparent layer comprises an asymmetry for orienting the analog code of the substantially non-transparent polymer layer. In some embodiments, the two-dimensional shape of the substantially non-transparent polymer layer is generated by lithography. In some embodiments, the two-dimensional shape of the substantially non-transparent polymer layer comprises a gear shape comprising a plurality of gear teeth, and wherein the analog code is represented by one or more embodiments selected from the group consisting of the height of one or more gear teeth of the plurality, the width of one or more gear teeth of the plurality, the number of gear teeth in the plurality, and the arrangement of one or more gear teeth within the plurality. In some embodiments, the plurality of gear teeth comprises one or more gear teeth that are between about 1 μm and about 10 μm wide. In some embodiments, the plurality of gear teeth comprises one or more gear teeth that are between about 1 μm and about 10 μm tall. In some embodiments, the plurality of gear teeth comprises two or more gear teeth that are spaced between about 1 μm and about 10 μm apart. In some embodiments, the method further comprises (f) before step (a), depositing a sacrificial layer on a substrate; (g) creating one or more column-shaped holes in the sacrificial layer using lithography; (h) depositing a third substantially transparent polymer layer in the one or more column-shaped holes in the sacrificial layer, wherein the first substantially transparent polymer layer is deposited in step (a) on top of the third substantially transparent polymer layer and the sacrificial layer; (i) after step (e), depositing using lithography one or more columns comprising the substantially transparent polymer on the first surface of the second substantially transparent polymer layer at a portion not covered by the substantially non-transparent polymer layer; (j) dissolving the sacrificial layer in a solvent; and (k) removing the substrate. In some embodiments, the method further comprises: (f) before step (a), depositing a sacrificial layer on a substrate; (g) as part of step (a), depositing the substantially transparent polymer layer on the sacrificial layer; (h) after step (e), dissolving the sacrificial layer in a solvent; and (i) removing the substrate. In some embodiments, the encoded microcarrier is a substantially circular disc. In some embodiments, the center portion of the first substantially transparent polymer layer comprises between about 5% and

[0017] In another aspect, provided herein is an encoded microcarrier produced by the method of any of the above embodiments.

[0018] In another aspect, provided herein is a method of making an encoded microcarrier, comprising: (a) depositing a sacrificial layer on a substrate; (b) depositing on the sacrificial layer a substantially non-transparent polymer layer having an outline, a first surface, and a second surface, the first and the second surfaces being parallel to each other, wherein the second surface is affixed to the sacrificial layer; (c) shaping by lithography the outline of the substantially non-transparent polymer layer, wherein the outline is shaped into a two-dimensional shape representing an analog code; (d) dissolving the sacrificial polymer layer in a solvent; and (e) removing the substrate. In another aspect, provided herein is a method of making an encoded microcarrier, comprising: (a) depositing a sacrificial layer on a substrate; (b) depositing a magnetic layer comprising a magnetic material on the sacrificial layer; (c) depositing on the magnetic layer a substantially non-transparent polymer layer having an outline, a first surface, and a second surface, the first and the second surfaces being parallel to each other, wherein the second surface is affixed to the magnetic layer; (d) shaping by lithography the outline of the substantially non-transparent polymer layer, wherein the outline is shaped into a two-dimensional shape representing an analog code; (e) dissolving the sacrificial polymer layer in a solvent; and (f) removing the substrate.

[0019] In some embodiments, the methods further include (g) after step (b) and before step (c), shaping the magnetic layer by lithography. In some embodiments, the magnetic material comprises nickel. In some embodiments, the microcarrier comprises an orientation indicator for orienting the analog code of the substantially non-transparent polymer layer. In some embodiments, the orientation indicator comprises an asymmetry of the outline of the substantially non-transparent polymer layer. In some embodiments, the two-dimensional shape of the substantially non-transparent polymer layer comprises a gear shape comprising a plurality of gear teeth, and wherein the analog code is represented by one or more embodiments selected from the group consisting of the height of one or more gear teeth of the plurality, the width of one or more gear teeth of the plurality, the number of gear teeth in the plurality, and the arrangement of one or more gear teeth within the plurality. In some embodiments, the plurality of gear teeth comprises one or more gear teeth that are between about 1 μm and about 10 μm wide. In some embodiments, the plurality of gear teeth comprises one or more gear teeth that are between about 1 μm and

solution comprises a biological sample. In some embodiments, the biological sample is selected from the group consisting of blood, urine, sputum, bile, cerebrospinal fluid, interstitial fluid of skin or adipose tissue, saliva, tears, bronchial-alveolar lavage, oropharyngeal secretions, intestinal fluids, cervico-vaginal or uterine secretions, and seminal fluid.

[0023] The present disclosure also provides a kit or article of manufacture comprising a plurality of microcarriers, wherein the plurality of microcarriers comprises at least: (a) a first microcarrier according to any of the above embodiments that specifically captures a first analyte, wherein the first microcarrier is encoded with a first analog code; and (b) a second microcarrier according to any of the above embodiments that specifically captures a second analyte, wherein the second microcarrier is encoded with a second analog code, and wherein the second analog code is different from the first analog code.

[023a] In another aspect, provided herein is a kit for conducting a multiplex assay comprising a plurality of microcarriers, wherein the plurality of microcarriers comprises at least:

(a) a first microcarrier according to any of the above embodiments that specifically captures a first analyte, wherein the first microcarrier is encoded with a first analog code; and

(b) a second microcarrier according to any of the above embodiments that specifically captures a second analyte, wherein the second microcarrier is encoded with a second analog code, and wherein the second analog code is different from the first analog code.

[0024] In some embodiments, the kit or article of manufacture further comprises a detection agent for detecting an amount of the first analyte bound to the first microcarrier and an amount of the second analyte bound to the second microcarrier. In some embodiments, the kit or article of manufacture further comprises instructions for using the kit to detect the first analyte and the second analyte.

[0025] It is to be understood that one, some, or all of the properties of the various embodiments described herein may be combined to form other embodiments of the present disclosure. These and other embodiments of the present disclosure will become apparent to one of skill in the art.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] **FIGS. 1A & 1B** show two views of an exemplary microcarrier.

[0027] **FIGS. 1C & 1D** show an exemplary assay for analyte detection using an exemplary microcarrier.

[0028] **FIGS. 2A & 2B** show two views of an exemplary microcarrier.

[0029] **FIG. 3** shows an exemplary analog encoding scheme that includes multiple shape variation points for generating unique analog codes.