CLAIMS

1. A method of calibrating an apparatus, comprising

placing a sample well having a solid fluorescence standard disposed therein into the apparatus, wherein the solid fluorescence standard comprises:

an adhesive, and

a selected quantity of substantially non-photobleaching fluorescent particles dispersed in the adhesive, wherein the adhesive is cured and solidified after being disposed in the sample well, wherein the non-photobleaching fluorescent particles are quantum dots that absorb and emit light in the range of 350 nm to 850 nm,

illuminating the sample well using an optical system of the apparatus,

measuring fluorescent signal from the solid fluorescence standard, and

adjusting a feature of the optical system based on the fluorescent signal.

2. The method of calibrating of claim 1, wherein the feature of the optical system is one or more of alignment of an excitation light source, light intensity of an excitation light source, a fluorescent detection system, or normalization of a fluorescence signal.

3. The method of calibrating of claim 1, wherein the apparatus is a thermocycler configured for real-time PCR amplification and fluorescent monitoring.

4. The method of calibrating of claim 1, wherein the sample well is a one or more wells of a multi-well plate.

5. The method of calibrating of claim 4, wherein the multi-well plate is a 96-well plate and the solid fluorescence standard is contained in one or more wells of the 96-well plate.

6. The method of calibrating of claim 4, wherein the multi-well plate is a second-stage array of a self-contained analysis array, or pouch.

7. The method of calibrating of claim 1, wherein the substantially non-photobleaching fluorescent particles are evenly dispersed in the adhesive before and after being cured and solidified.

8. The method of calibrating of claim 1, wherein the adhesive is a low viscosity, substantially optically transparent, solvent-free, radiation curable adhesive.

9. The method of calibrating of claim 1, wherein the adhesive is a UV curable adhesive.

10. The method of calibrating of claim 1, wherein the adhesive has a viscosity of 10-100 centipoise at 15-25 °C.

11. The method of calibrating of claim 1, wherein the adhesive has a viscosity of 15-25 centipoise at 15-25 °C.

12. The method of calibrating of claim 1, wherein the substantially non-photobleaching fluorescent particles are included in the adhesive at a concentration adapted for providing a defined emission intensity at a selected wavelength and excitation intensity.

13. The method of calibrating of claim 1, wherein the apparatus comprises:

a thermocycler configured to receive the sample well; and

the optical system comprising an optical excitation system and an optical observation system, wherein the optical system is positioned in the apparatus for illumination and observation of contents of the sample well.

14. The method of calibrating of claim 13, wherein the thermocycling system further comprises:

a heating and cooling system;

a control system for operating the heating and cooling system; and

a temperature sensing system configured for sensing the temperature in the sample well, the temperature sensing system being operatively connected the heating and cooling system and the control system such that the temperature of the sample well can be rapidly and controllably increased and decreased by the heating and cooling system in response to a temperature sensed by the temperature sensing system such that the sample well can be subjected to rapid thermal cycling.

15. The method of calibrating of claim 14, wherein the control system includes an external computing device that is operatively coupled to at least one of the thermocycling system, the optical system, the heating and cooling system, the control system, or the temperature sensing system.

16. An apparatus calibrated according to the method of any one of claims 1-15.

17. An apparatus, comprising:

a thermocycler configured to receive a sample well;

an optical system comprising an optical excitation system and an optical observation system, wherein the optical system is positioned in the apparatus for illumination and observation of contents of the sample well; and

a solid fluorescence standard disposed in a sample well, the sample well being disposed in the thermocycler, wherein the solid fluorescence standard comprises:

an adhesive, and

a selected quantity of substantially non-photobleaching fluorescent particles dispersed in the adhesive, wherein the adhesive is cured and solidified after being disposed in the sample well, wherein the non-photobleaching fluorescent particles are quantum dots that absorb and emit light in the range of 350 nm to 850 nm.

18. The apparatus of claim 17, wherein the sample well is a well of a multi-well plate, and wherein one or more wells of the multi-well plate have the solid fluorescence standard disposed therein.

19. The apparatus of claim 18, wherein the multi-well plate is a 96-well plate.

20. The apparatus of claim 19, wherein the solid fluorescence standard is included in two or more wells of the 96-well plate.

21. The apparatus of claim 17, wherein the sample well comprises one or more wells of a second-stage array of a self-contained analysis array, or pouch.

22. The apparatus of claim 17, wherein the substantially non-photobleaching fluorescent particles are included in the adhesive in the sample well at a concentration adapted for providing a defined emission intensity at a selected wavelength and excitation intensity.

23. The apparatus of claim 17, wherein the thermocycling system further comprises:

a heating and cooling system;

a control system for operating the heating and cooling system; and

a temperature sensing system configured for sensing the temperature in the sample well, the temperature sensing system being operatively connected the heating and cooling system and the control system such that the temperature of the sample well can be rapidly and controllably increased and decreased by the heating and cooling system in response to a temperature sensed by the temperature sensing system such that the sample well can be subjected to rapid thermal cycling.

24. The apparatus of claim 23, wherein the control system includes an external computing device that is operatively coupled to at least one of the thermocycling system, the optical system, the heating and cooling system, the control system, or the temperature sensing system.

25. The apparatus of any one of claims 17-24, wherein the apparatus is calibrated by a process that includes calibrating the apparatus with the solid fluorescence standard, wherein the process includes:

illuminating the solid fluorescence standard using the optical system of the apparatus, and measuring fluorescent signal from the solid fluorescence standard,

wherein the calibrating comprises adjusting a feature of the optical system based on the fluorescent signal from the solid fluorescence standard, and

wherein the feature of the optical system is one or more of alignment of an excitation light source, light intensity of an excitation light source, a fluorescent detection system, or normalization of a fluorescence signal.

26. The apparatus of any one of claims 17-24, wherein the apparatus is fabricated by a process that includes calibrating the apparatus according the method of any one of claims 1-15.