

THERMAL BLOCK ASSEMBLIES AND INSTRUMENTS PROVIDING LOW THERMAL NON-UNIFORMITY FOR RAPID THERMAL CYCLING

FIELD

[0001] The field of the present teachings is for a thermal block assembly for a thermal cycling apparatus.

BACKGROUND

[0002] The analysis of thermal non-uniformity (TNU) is an established attribute of the art for characterizing the performance of a thermal block assembly, which may be used in various bioanalysis instrumentation. The TNU is typically measured in a sample block portion of a thermal block assembly, which sample block may engage a sample support device. The TNU may be expressed as either the difference or the average difference between the hottest and the coolest locations in the sample block. For example, the TNU may be determined as a difference or average difference between a hottest and a coldest sample temperature or position in a sample block. An industry standard, set in comparison with gel data, may express a TNU so defined as a difference of about 1.0 °C, or an average difference of 0.5 °C. Historically, the focus on reducing TNU has been directed towards the sample block. For example, it has been observed that the edges of the sample block are typically cooler than the center. One approach that has been taken to counteract such edge effects is to provide various perimeter and edge heaters around the sample block to offset the observed thermal gradient from the center to the edges.

[0003] In the present teachings, modeling was validated for comparing trends in various thermal block assembly designs using experimental data. Such modeling lead to a redesign of the thermal block assembly, which embodiments according to the present teachings are in contrast to various established teachings of the art.

SUMMARY

[0004] A thermal block assembly providing low thermal non-uniformity for rapid thermal cycling as well as various embodiments thereof and various embodiments of apparatuses incorporating such a thermal block assembly are defined in the attached claims. According to a first aspect of the present invention, there is provided a thermal block assembly for thermal cycling comprising: a sample block having a first surface and a second surface, wherein the first surface is adapted for receiving a sample support device; a heat sink comprising a base having a first surface, a second surface and a plurality fins pendant the second surface, wherein a space between each fin provides for a flow path for air passing from an inlet side of the plurality of fins to an outlet side the plurality of fins; and a plurality of thermal electric devices positioned between the sample block and heat sink, wherein the footprint of the plurality of thermal electric devices effectively matches the footprint of the second surface of the sample block and first surface of the heat sink to provide substantially uniform heat transfer throughout the thermal block assembly.

[0004a] According to a second aspect of the present invention, there is provided an apparatus comprising a control system, and a thermal block assembly as defined in the first aspect.