

Development of microheater based on magnetic nanoparticle-embedded PDMS

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We developed a novel heating method that is based on magnetic nanoparticle-embedded PDMS (MNP-PDMS). Magnetic nanoparticles were embedded into a PDMS elastomer for use as a heating element. Magnetic nanoparticles generate heat under an externally applied AC magnetic field due to magnetic loss and the temperature was controlled by varying the magnetic nanoparticle content and the magnetic field intensity. In this study, we demonstrated the feasibility of developing a microheater based on MNP-PDMS chip and investigated the thermal properties of this system. PCR was performed to verify that the MNP-PDMS was capable of allowing for a biochemical reaction as a heating unit. MNP-PDMS chip was demonstrated to amplify the target DNA (732 bp) with > 90 % efficiency compared to the conventional PCR thermocycler and exhibited good performance in regards to temperature control. Consequently, this MNP-PDMS heating element holds great promise for use as local and versatile heating units in an integrated microfluidic platform.