Pengembangan proses pembuatan dan pengukuran kinerja micro channel heat exchanger berbasis biomachining = Development of manufacturing process and performance measurement of micro channel heat exchanger based on biomachining

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Abstrak

[ABSTRAK
Fabrikasi berskala mikro sedang terus dikembangkan sebagai kebutuhan dimasa yang akan datang. Salah satu variasinya menggunakan mikroorganisme bakteri (biomachining). Penelitian sebelumnya telah membuktikan kemampuan jenis bakteri Acidithiobacillus ferooxidans untuk melakukan pemakanan permukaan beberapa material logam, salah satunya yaitu tembaga (Cu). Perkembangan teknologi biomachining akan diterapkan sebagai metode manufaktur beberapa perangkat mikro, seperti micro-needle dan micro-channel. Pada penelitian sebelumnya, didapatkan nilai kekasaran permukaan (Ra) rata-rata hasil proses biomachining pada material tembaga yaitu berkisar antara 5-8 μm. Nilai tersebut tergolong cukup besar dan dimanfaatkan untuk membuat micro-channel. Micro-channel akan menjadi sebuah komponen dalam sistem penukar kalor berskala mikro, yang lebih dikenal sebagai micro-heat exchanger. Tujuannya, kekasaran permukaan micro-channel dapat memperluas area alir dan membuat fluida kerja lebih turbulen. Parameter tersebut akan mempengaruhi transfer rate sistem micro heat exchanger. Namun, nilai pressure drop pada penelitian ini berbanding lurus dengan tingkat kekasaran channel. Hasil eksperimen perpindahan panas menunjukkan sampel biomachining memiliki nilai perbedaan temperatur (ΔT) lebih besar 22,49% dan 34,34% berurutan menggunakan variasi flow rate 16 mL/min dan 64 mL/min.
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ABSTRACT
Micro-scale fabrication is being continuously developed as the needs of the future. One of the methods uses microorganisms culture (biomachining). The previous research has shown the ability of Acidithiobacillus ferooxidans in the characterization and result of material removal process with copper (Cu) as the workpieces. Biomachining will be applied as a method of micro devices manufacturing, such as micro-needle and micro-channel. In the previous study, obtained the value of surface roughness average (Ra) of biomachining process results in copper material in range from 5-8 μm. This value is quite large and oriented in the making of micro-channel. Micro-channel will be put in the center structure of micro-heat exchanger system. The major goal is the surface roughness can expands the micro-channel flow area and makes the fluid more turbulent. In addition, these parameters will affect the transfer rate of a micro-heat exchanger system. However, the pressure drop results of this research are proportional to the rate of surface roughness. The experimental results show the biomachining sample heat transfer temperature difference value (ΔT) greater 22.49% and 34.34% using a variation of flow rate 16 mL / min and 64 mL / min respectively;Micro-scale fabrication is being continuously developed as the needs of the future. One of the methods uses microorganisms culture (biomachining). The previous research has shown the ability of Acidithiobacillus ferooxidans in the characterization and result of material removal process with copper (Cu) as the workpieces. Biomachining will be applied as a method of micro devices manufacturing, such as

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