An Economic and Environmental Assessment Model for Microchannel Device Manufacturing

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Abstract

A key application of microchannel process technology (MPT) is its implementation in heat exchanger devices, since a larger surface contact area can be realized than in conventional approaches, thus achieving high heat transfer efficiency. To justify high volume production of configurations validated as prototypes, and to select from among the plethora manufacturing techniques according to sustainable manufacturing requirements, an evaluation of the manufacturing economics and environmental impacts is needed. A spreadsheet-based economic and environmental impact assessment model is thus developed for microchannel device manufacturing. Bottom-up process-based cost calculation and the process-based cradle-to-gate life cycle assessment methods are integrated in this model to evaluate the manufacturing cost and environmental impacts for microchannel devices at a range of production volumes. A graphical user interface allows users to manipulate the model by modifying various production and device geometry parameters. This model provides users a more comprehensive understanding of the composition of manufacturing costs and environmental impacts, thus providing quantitative support for selecting MPT manufacturing strategies. A case study is given to demonstrate the analysis of cost and environmental impacts of several microchannel device manufacturing scenarios with this model.

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