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Data Article

Dataset demonstrating effects of momentum transfer on sizing of current collector for lithium-ion batteries during laser cutting

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ABSTRACT

Material properties of copper and aluminum required for the numerical simulation are presented. Electrodes used for the (paper) are depicted. This study describes the procedures of how penetration depth, width, and absorptivity are obtained from the simulation. In addition, a file format extracted from the simulation to visualize 3D distribution of temperature, velocity, and melt pool geometry is presented.

Specifications Table

Subject area	*Mechanical engineering, Manufacturing engineering, Applied physics, Computational Analysis*
More specific subject area	*Laser cutting, lithium-in battery manufacturing engineering*
Type of data	*Table, graph and figure*

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How data was acquired	*Material properties are obtained from ref []. Raw data of numerical simulation are obtained by Fortran90. The raw data are filtered and analyzed by MATLAB. Filtered data are plotted with Tecplot*
Data format	*Raw, filtered, and analyzed*
Data source location	*Cheonan, South Korea*
Data accessibility	*Dataset is within this article*
Related research article	*Dongkyoung Lee, Jyotirmoy Mazumder, Effects of momentum transfer on sizing of current collector for lithium-ion batteries during laser cutting* [1]

Value of the data

- The summary of material properties can be easily accessed from the various applications since copper and aluminum are popular materials.
- Researchers could be referred to this dataset to design, compare, analyze, and validate another theoretical model of laser cutting on current collectors.
- Analyzing these data, one can compare and ensure the validity of experimental approaches and results.
- The values of the performance parameters can be used to compare the simulation result of laser cutting of current collector for lithium-ion batteries

1. Data

The material properties for current collector materials such as copper and aluminum used for the mathematical model have been presented in Table 1 and Table 2 respectively. All of these material properties are extracted from the published literatures [2–7].

Along with this dataset, the simulation parameters are tabulated in Table 3. Fig. 1 and Fig. 2 show depth changes during laser cutting of copper and aluminum depending on elapsed time, respectively. Depth values are measured from the material surface ($Z=0$) to the tip of penetration hole, which is the minimum Z value of the liquid/vapor interface coordinate($Z=\min(\phi_{L/V})$) [1]. Fig. 3 and Fig. 4 show

Table 1
Material properties of copper.

Property	Value
Melting temperature	1357.77(K)
Normal boiling temperature	2835.15(K)
Critical point temperature	8280(K)
Liquid density	7920(kg m^{-3})
Solid density	8960(kg m^{-3})
Kinematic viscosity	3.50E-07(m^2 s^{-1}) [2]
Surface tension	1.257-0.0002*(T-1356) (N m^{-1}) [3]
Latent heat of vaporization	5.23E+06(J kg^{-1})
Latent heat of fusion	2.05E+05(J kg^{-1})
Solid thermal conductivity	317(W m^{-1} K^{-1}) [4]
Liquid thermal conductivity	157(W m^{-1} K^{-1}) [4]
Liquid constant-pressure specific heat	571.6218(J kg^{-1} K^{-1})
Solid constant-pressure specific heat	385(J kg^{-1} K^{-1}) [5]
Liquid thermal diffusivity	3.62E-05(m^2 s^{-1})
Solid thermal diffusivity	7.63E-05(m^2 s^{-1})
Laser absorptivity for flat surface	0.05