

Additional Materials

1. The Inventory Data

Table S1 Data collection for the manufacturing unit process of a steel instrument crossbeam.

	Substance	Unit	Quantity
Input	Steel	kg	9.22E+00
	Welding Wire	kg	1.14E-01
	Electricity	MJ	1.71E+00
	Compressed Air	Nm ³	7.36E-01
	Iron Frame	kg	1.14E+01
Output	Steel Instrument Panel Crossmember	kg	8.17E+00
	Scrap	kg	7.60E-01
	Carbon Dioxide	kg	4.75E-02

Table S2 Data collection for the manufacturing unit process of a magnesium alloy instrument crossbeam.

	Substance	Unit	Quantity
Input	Aluminum Alloy (Instrument Panel Crossmember Body)	kg	6.25E+00
	Electricity	MJ	2.05E+01
	Flange Nut (65 Mn)	kg	1.62E-03
	Screw M6 (20 MnTiB)	kg	9.41E-03
	Double-ended Stud M (810B21)	kg	1.71E-02
	Corrugated Paper	kg	2.39E+00
	Non-stick Adhesive	kg	4.75E-03
Output	Aluminum Alloy Instrument Panel Crossmember	kg	5.72E+00
	Aluminum-containing Solid Waste	kg	6.18E-01

Table S3 Data collection for the transport and assembly unit process of a steel instrument crossbeam.

	Substance	Unit	Quantity
Input	Truck Transport	km	6.00E+01
	Adhesive	kg	4.75E-01
	Electricity	MJ	1.37E+01
Output	Vehicle Body	piece	1.00E+00

Table S4 Data collection for the transport and assembly unit process of a magnesium alloy instrument crossbeam.

	Substance	Unit	Quantity
Input	Truck Transport	kg	1.51E+03
	Bolt	MJ	4.75E-01
Output	Vehicle Body	piece	1.00E+00

Table S5 Operational unit process data collection for steel and magnesium alloy instrument crossbeams.

	Substance	Unit	Quantity
Input	Electricity (Steel)	MJ	6.42E+02
	Electricity (Magnesium Alloy)	MJ	4.50E+02
Output	N ^a	N ^a	N ^a

(a: The material was not produced).

Table S6 Recycling unit process data collection for steel and magnesium alloy instrument crossbeams.

	Substance	Unit	Quantity
Input	Electricity (Steel)	MJ	2.12E+00
	Electricity (Magnesium Alloy)	MJ	2.06E+00
Output	N ^a	N ^a	N ^a

(a: The material was not produced).

2. Normalization and Weighting Results of Instrument Crossbeam in Different Regions

Table S7 Normalization and weighting results of steel instrument crossbeam in different regions.

Power grid	GWP	AP	EP	ODP	POCP	Comprehensive environmental impact
Northern power grid	5.47E-12	2.79E-12	3.97E-13	3.94E-18	2.19E-12	2.44E-12
Southern power grid	3.74E-12	1.89E-12	2.66E-13	1.71E-18	1.50E-12	1.66E-12
Central power grid	3.91E-12	1.97E-12	2.79E-13	2.67E-18	1.57E-12	1.74E-12
Eastern power grid	4.92E-12	2.50E-12	3.55E-13	3.25E-18	1.97E-12	2.19E-12

Table S8 Normalization and weighting results of magnesium alloy instrument crossbeam in different regions.

Power grid	GWP	AP	EP	ODP	POCP	Comprehensive environmental impact
Northern power grid	7.87E-12	3.45E-12	4.92E-13	4.58E-18	2.50E-12	3.28E-12
Southern power grid	6.66E-12	2.82E-12	4.01E-13	3.04E-18	2.02E-12	2.74E-12
Central power grid	6.77E-12	2.88E-12	4.09E-13	3.71E-18	2.07E-12	2.79E-12
Eastern power grid	7.48E-12	3.25E-12	4.62E-13	4.12E-18	2.35E-12	3.11E-12