

## Unlocking the Potential in Aluminum can Revolutionize the World

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Aluminum has changed the face of the planet in the 20<sup>th</sup> century. As we unlock the potential of this abundant metal, our lives are on the fringe of an imminent revolution.

We cannot imagine our current lifestyle without one particular element, aluminum. While steel and iron were the foundation metals of the industrial revolution, aluminum has changed the face of manufacturing and transportation industries in the 20<sup>th</sup> century. The aluminum market continues to rise in the 21<sup>st</sup> century, especially in India and China, fueled by rapid growth and urbanization. Allied Market Research valued the aluminum market at \$133,564 million in 2015 and is expected to reach \$167,277 million by 2022, registering a CAGR of 3.3% from 2016 to 2022 [1].

### What Makes Aluminum So Special?

The wide-spread use of aluminum and its alloys as an alternative to other substances stems from its high abundance and noble physical properties. Accounting around 8% of the earth's crust by mass, aluminum is the most abundant metal on the earth's surface and is found in over 270 different minerals and ores. Its low weight, low density and durability (resistance to corrosion) make it efficient for replacing steel in manufacturing and transportation industries. Aluminum and its alloys are especially vital in the aerospace industries, as they require light material that could sustain the drag pressure of high-speed travel. Owing to its high reflective coefficient and significant reflective properties, it's widely used in making reflective layer in mirrors. The high ductile and malleable properties of aluminum are exploited in the food industry for the manufacturing foils for packaging. Finally, its high conductive properties are also utilized in the power industry; as a substitute for copper in electrical transmission lines.

### Recent Developments in Aluminum Research

As the world keeps progressing, the need for lighter, stronger and versatile materials keeps increasing as well. This has inspired researchers to develop innovative, more effective, and cheaper aluminum products that could be mass-produced in the market. Scientists at Pacific Northwest National Laboratory (PNNL) have developed a new process [2], friction stir dovetailing (FSD), for joining aluminum and steel parts. Joining the two materials result in stronger, lighter and more ductile product that could transform the transportation industry. The new joint material can be used in the manufacturing of light weighted vehicles with superior strength of steel, which provides more agility and fuel efficiency. A joint collaboration between U.S. and Chinese universities has also demonstrated the creation of a super strong aluminum alloy [3] that could rival the strength of stainless steel. By introducing "stacking faults" in the crystal structure of aluminum, they have managed to impart greater strength and ductility to existing aluminum alloys. The leading scientist in the study and a professor in Purdue University's School of Materials Engineering, Xinghang Zhang, states that "lightweight aluminum alloys with strength comparable to stainless steels would revolutionize the automobile and aerospace industries".

### Recycling Aluminum

Recycling aluminum is far less expensive and energy intensive,

requiring just 5% of the energy used in making aluminum from the ore. Scrap Aluminum, obtained from daily used household products like beverage containers, can be melted and manufactured back into other aluminum products. At present, approximately 36% of all aluminum produced in the U.S. comes from old recycled scrap. While it may sound like a good conversion amount, Brazil recycles 98.2% of its aluminum can production. Recycling of more aluminum can put a stop to production, export and import of AL, and reduce the trade wars [3] in the future.

### Aluminum: The Eco-Friendly Metal

As the world moves towards more eco-friendly alternatives and tries to mitigate carbon emissions, engineers and developers have turned their eyes towards aluminum to solve some of these problems. As solar energy becomes more prevalent in generating electricity across the world, researchers have found out that embedding aluminum studs in solar panels can increase their efficiency by 22%. Aluminum is also suggested as an alternative to plastic, due to its strength and reliability. A substantial reduction in cost of aluminum can see it replace plastic in various industries and can help in reducing the amount of non-biodegradable material on earth.

Aluminum and its alloys truly hold the key for sustainable living in the future. Innovative research in the metal has already managed to generate stronger and cheaper alloys, which holds the potential to transform automobile, aerospace and transportation industries. Recycling aluminum is set to take precedent, and the process could get more cheaper and efficient – enabling people to use it as an alternative to plastic. We are living in the fringe of a revolution, which could start anytime by unlocking the true potential that this majestic metal holds.

### References

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