Business Case Study

Opportunity Assessment:

Amorphous Metals Opportunity in Electric Mobility

FutureBridge

Case study: Amorphous Metals in Electric Mobility (1 / 2)

Client	Leading material supplier and component manufacturer
Industry	Automotive (EV) , electronics
Product / technology	Amorphous metal

Context

• Client seeks to unearth both existing and upcoming opportunities for its amorphous metal offerings in electric vehicle including charging infrastructure.

Key business questions

• What are different nodes in amorphous metal based components' value chain in electric vehicles?
• Which are most attractive existing components to target?
• What is the current market and outlook for existing components?
• Which upcoming components that are seeing major R&D activities and promising application in EVs
• Who are the major customers of the components and amorphous metal?
• Who are the decision makers in value chain for material selection? What are unmet needs related to material's performance?

Engagement scope

1 Universe building and two-level shortlisting

• What is the universe of existing EV components / sub-components based on amorphous metals ?
• Level #1 shortlisting based on technical evaluation .
• Level #2 shortlisting based on the quantitative and qualitative criteria

2 Deep dive into attractive components / sub-components

• What is the current market for component / sub-component?
• What's the outlook for component / sub-component and expected penetration rates in the future?
• What are unmet needs in terms of material for various components?
• What are decision criteria?

3 Analysis on upcoming components / sub-components

• Innovation landscape through patent, technical, and business literature
• Profile of upcoming components / sub-components based on technology and TRL level
• What is the addressable market for upcoming components and expected penetration rates in the future?

4 Key findings and conclusions

• Attractive components to focus in near future with attractive geographies
• Detailed analysis voice of customers and unmet need w.r.t. existing material for components in EV.
• Potential partners among different players in value chain

Case study: Amorphous Metals in Electric Mobility (2 / 2)

Research methodology

Secondary research

- Paid commercial, IP, and technical databases
- Company website, annual reports, investor presentations, TDS, trade journal, associations, publications, etc.

Primary research

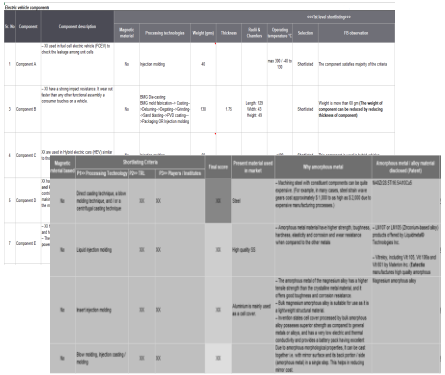
- 45+ telephonic interviews with major amorphous metal and component manufacturers, thought leaders, independent consultants and analysts

Benefits to Client

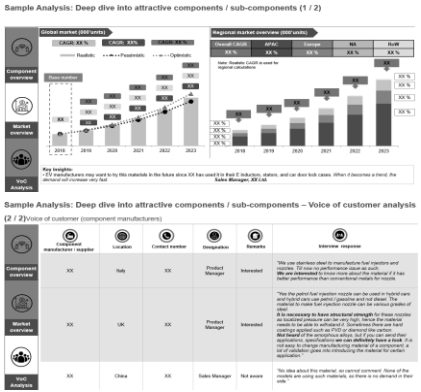
- Ranking of each of the shortlisted components / sub-components based on their attractiveness
- Attractive geographies to focus on
- Understanding of the current unmet need of customers with respect to current material / supplier
- Addressable market size for AM-based components in electric vehicles
- Understanding of the existing penetration level of AM in EV components
- Customers that are interested to use AM based components

Sample analysis

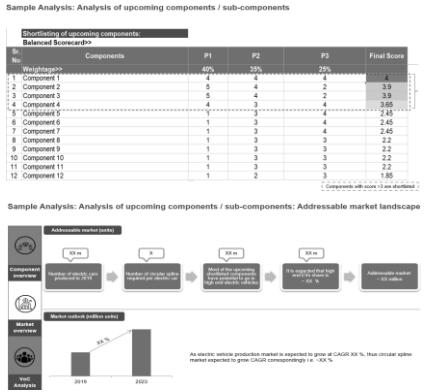
1 Universe building and two-level shortlisting



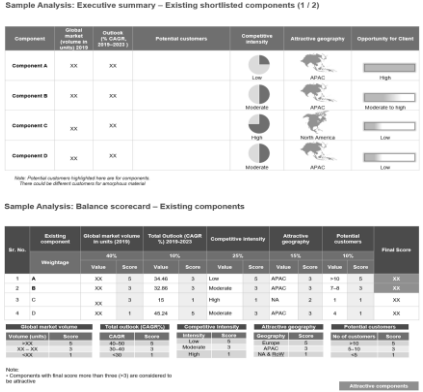
2 Deep dive into attractive components / sub-components



3 Analysis on upcoming components / sub-components



4 Key findings and conclusions



Sample Analysis: Existing components – Universe building and 1st level shortlisting

Electric vehicle components

Sr. No	Component	Component description	<<<1st level shortlisting>>>							
			Magnetic material	Processing technologies	Weight (gms)	Thickness	Radii & Chamfers	Operating temperature °C	Selection	FB observation
1	Component A	– XX used in fuel cell electric vehicle (FCEV) to check the leakage among unit cells	No	Injection molding	40			max 300 / -40 to 130	Shortlisted	The component satisfies majority of the criteria
3	Component B	– XX have a strong impact resistance. It wear out faster than any other functional assembly a consumer touches on a vehicle.	No	BMG Die-casting: BMG mold fabrication--> Casting-->Deburring-->Degating-->Grinding-->Sand blasting-->PVD coating-->Packaging OR Injection molding	130	1.75	Length: 129 Width: 43 Height: 49		Shortlisted	Weight is more than 60 gm **(The weight of component can be reduced by reducing thickness of component)**
4	Component C	XX are used in Hybrid electric cars (HEV) similar to those in ICE vehicles.	No	Injection molding	50			<400	Shortlisted	This component is used in hybrid vehicles
5	Component D	XX has **high saturation magnetic flux density and low loss**, the amorphous material contributes to miniaturization of the motor making the reduction of the temperature rise of the motor during operation	No	Stamping / laser cutting	Stator + rotor < 2kg		OD: 22±0.05, ID: 10±0.05 Height: 12±0.05	55–130	Shortlisted (After discussion with XX Team)	Processing technology involves stacking and cutting, Weight is more than 60 gm
					< 1000	0.12–0.8	width: 50–1250			
						0.05–0.5	OD: 220–320			
7	Component E	– XX have low loss, high magnetic flux density, and high reliability – They are suited to coils for higher switching power electronics applications.	Yes	Powder Metallurgy / Amorphous ribbon wrapping	Depends on length of ribbon used to make core	Depends on ribbon used to make core	ID: 11–33 OD: 23–61 Height: 8–19	150	Rejected	FB team observed that core is made of amorphous powder core, but the component is magnetic in nature.

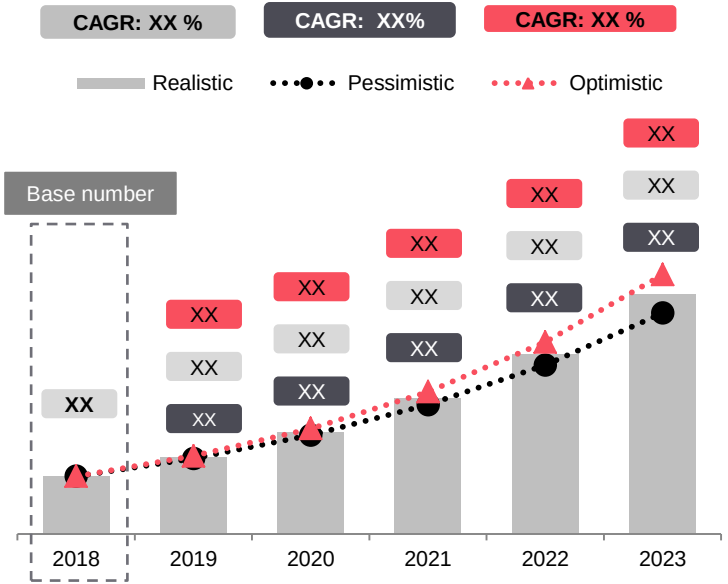
Sample Analysis: Deep dive into attractive components / sub-components (1 / 2)

Component overview

Market overview

VoC Analysis

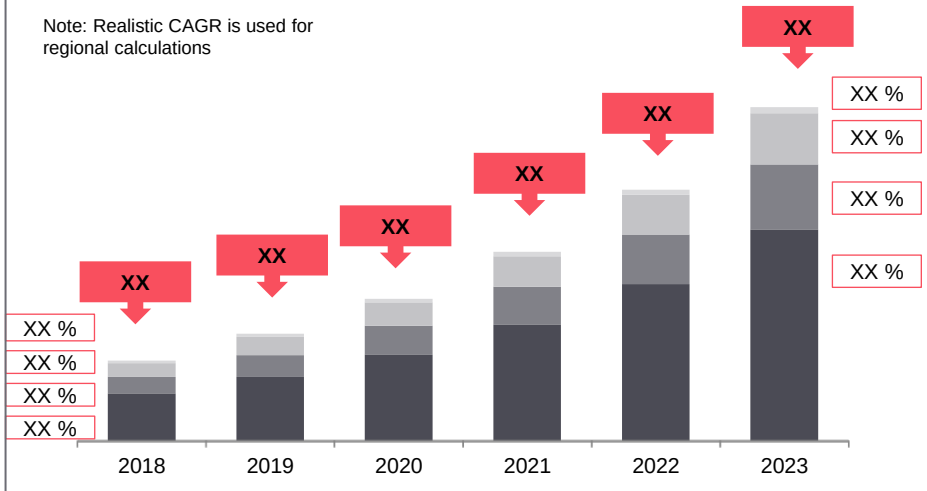
Global market (000'units)



Regional market overview (000'units)

Overall CAGR	APAC	Europe	NA	RoW
XX %	XX %	XX %	XX %	XX %

Note: Realistic CAGR is used for regional calculations



Key insights:

• EV manufacturers may want to try this materials in the future since XX has used it in their E inductors, stators, and car door lock cases. *When it becomes a trend, the demand will increase very fast.* ***Sales Manager, XX Ltd.***

Sample Analysis: Deep dive into attractive components / sub-components – Voice of customer analysis (2 / 2) (component manufacturers)

Component overview

Market overview

VoC Analysis

Component manufacturer / supplier	Location	Contact number	Designation	Remarks	Interview response
XX	Italy	XX	Product Manager	Interested	*"We use stainless steel to manufacture fuel injectors and nozzles. Till now no performance issue as such.* ***We are interested*** *to know more about the material if it has better performance than conventional metals for nozzle.*
XX	UK	XX	Product Manager	Interested	*"Yes the petrol fuel injection nozzle can be used in hybrid cars and hybrid cars use petrol / gasoline and not diesel. The material to make fuel injection nozzle can be various grades of steel.* ***It is necessary to have structural strength*** *for these nozzles as localized pressure can be very high, hence the material needs to be able to withstand it. Sometimes there are hard coatings applied such as PVD or diamond like carbon.* ***Not heard*** *of the amorphous alloys, but if you can send their applications, specifications* ***we can definitely have a look****. It is not easy to change manufacturing material of a component, a lot of validation goes into introducing the material for certain application."*
XX	China	XX	Sales Manager	Not aware	*"No idea about this material, so cannot comment. None of the models are using such materials, so there is no demand in their side."*

Sample Analysis: Shortlisting of upcoming components / sub-components through balanced scorecard

Sr. No	Components	P1	P2	P3	Final Score
	Weightage>>	40%	35%	25%	
1	XX	4	4	4	4
2	XX	5	4	2	3.9
3	XX	5	4	2	3.9
4	XX	4	3	4	3.65
5	XX	1	3	4	2.45
6	XX	1	3	4	2.45
7	XX	1	3	4	2.45
8	XX	1	3	3	2.2
9	XX	1	3	3	2.2
10	XX	1	3	3	2.2
11	XX	1	3	3	2.2
12	XX	1	2	3	1.85

Components with score >3 are shortlisted

Sample Analysis: Analysis of upcoming components / sub-components – Addressable market landscape

Component overview

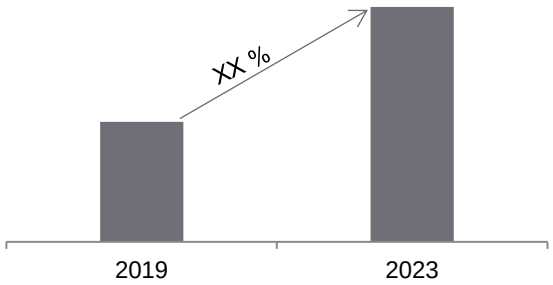
Market overview

VoC Analysis

Addressable market (units)

XX m	X	XX m	XX m	
Number of electric cars produced in 2019	Number of circular spline required per electric car	Most of the upcoming shortlisted components have potential to go in high end electric vehicles	It is expected that high end EVs share is ~ XX %	Addressable market: ~ XX million

Market outlook (million units)



As electric vehicle production market is expected to grow at CAGR XX %, thus circular spline market expected to grow CAGR correspondingly i.e. ~XX %

Sample Analysis: Executive summary – Existing shortlisted components (1 / 2)

Component	Global market (volume in units) 2019	Outlook (% CAGR, 2019–2023)	Potential customers	Competitive intensity	Attractive geography	Opportunity for Client
Component A	XX	XX		 Low	 APAC	 High
Component B	XX	XX		 Moderate	 APAC	 Moderate to high
Component C	XX	XX		 High	 North America	 Low
Component D	XX	XX		 Moderate	 APAC	 Low

Note: Potential customers highlighted here are for components. There could be different customers for amorphous material

Sample Analysis: Existing components – Balance score card

Sr. No.	Existing component	Global market volume in units (2019)		Total Outlook (CAGR %) 2019-2023		Competitive intensity		Attractive geography		Potential customers		Final Score
	Weightage	40%		10%		25%		15%		10%		
		Value	Score	Value	Score	Value	Score	Value	Score	Value	Score	
1	**A**	XX	5	34.46	3	Low	5	APAC	3	>10	5	XX
2	**B**	XX	3	32.86	3	Moderate	3	APAC	3	7–8	3	XX
3	C	XX	3	15	1	High	1	NA	2	1	1	XX
4	D	XX	1	45.24	5	Moderate	3	APAC	3	4	1	XX

Global market volume

Volume (units)	Score
>XX	5
XX – XX	3
<XX	1

Total outlook (CAGR%)

CAGR	Score
40–50	5
30–40	3
<30	1

Competitive Intensity

Intensity	Score
Low	5
Moderate	3
High	1

Attractive geography

Geography	Score
Europe	5
APAC	3
NA & RoW	1

Potential customers

No of customers	Score
>10	5
5–10	3
<5	1

Note:
• Components with final score more than three (>3) are considered to be attractive

Attractive components

Thank you

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