Aluminium alloy sacrificial anode for corrosion protection of Copper alloy based seawater pipelines of ships

Introduction

Cathodic protection in conjunction with anti-corrosive coatings is a common practice employed for controlling corrosion in marine environment. The cathodic protection is one of the electrochemical protection technique in which the structure to be protected from corrosion is made as cathode. The cathodic protection can be achieved mainly by two ways, Impressed Current Cathodic protection (ICCP) and sacrificial anode type cathodic protection. NMRL has developed various aluminium alloy based sacrificial anodes for corrosion protection of ships and submarines and inducted in Indian Navy. Aluminium is a preferred material to act as sacrificial anodes due to its low density, reasonable cost and high theoretical electrical capacity (due to formation of a trivalent cation).

Copper alloy based pipelines used in the ships are prone to corrosion due to flowing seawater. Raising the potential will be sufficient to cathodically protect the copper based alloy. The existing Al alloy based sacrificial anodes are having high open circuit potential leading to higher driving voltage between the anode and copper alloys. Using these anodes for corrosion protection of copper alloys results in wastage of anode material and having less service life. Again these anodes undergo erosion under flow of seawater.

Technology developed and its advantage. The present invention relates to the development of Aluminum alloy based low potential sacrificial anode for cathodic protection of copper alloy based seawater pipelines in marine environment. More particularly the present invention relates to the cathodic protection of copper alloy based seawater pipelines where seawater flow rate is 1 m/s with a max. pressure of 10 bar where conventional Al alloy based sacrificial anodes cannot be used.

Salient Features

The property of Aluminium anode for corrosion protection of copper alloy based flow system has the following features:

a) Current capacity: ≥ 2450 Ahr/Kg at a seawater velocity of 1m/s with a max. pressure of 10 bar.
b) The anodes are available in different shape and size, so that anodes can be selected as per requirement of the user. Anodes are designed to give maximum current output.

Application Areas

Cathodic protection with sacrificial anodes can be used for corrosion protection of copper alloy based pipelines of firefighting systems and other flow system used in the ship in marine medium.

Infrastructure and expertise required

Foundry, chemical analysis facility for quality control of raw materials and finished product, NDT equipments and power 50 KW. Experienced manpower in the field of foundry operations and chemist for quality control.

Potential users

The potential users of this technology are Indian Navy, Coast guard, Commercial ships, harbours and any other structures immersed in marine medium.

Interested Industries are requested to forward their Expression of Interest (EoI) to Director Name of the Lab, Place along will all supporting documents with a copy of EoI (without supporting documents) to Director DIITM, DRDO HQ on following address:-

Director
Naval Materials Research Laboratory
PO Anand Nagar
Ambernath (East)-421506
Phone : 0251-2623131

Fax : 0251-2623004
E-mail ID : director[dot]nmrl[at]gov[dot]in

Copy to

Director
Directorate of Industry Interface & technology Management (DIITM)
Room No. 447, DRDO Bhawan, DRDO HQrs,
Rajaji Marg, New Delhi-110011
Phone: 011-23013209/23015291
Fax: 011-23793008
Email: diitm[dot]hqr[at]gov]dot]in

All industries interested in seeking ToT are requested to apply in the format given below. Kindly fill in the fields. The list of documents to be attached is provided in Annexure – I. Kindly provide the reference of page no. of supporting document in the relevant field of form.

Application cum Industry Assessment Form

PART-1

General Information

(Please enclose documents in support of information provided)

1.	**Name of the Technology requested for Technology Transfer (Technology name and concerned Lab, Category)**	
2.	**Name of the industry/ organization**	
3.	**Complete Address and other details**	
	Registered Office State Phone No Fax Email Website	
	Factory State	

	Phone No Fax Email Website	
4.	**Point of Contact** Name Designation Address Mobile No Ph No Email ID	
5.	**NAME OF CMD/ MD /PARTNERS/ PROPRIETOR/ etc** Name Designation Address Mobile No Ph No Email ID	
6.	**Date of Incorporation of company**	
7.	**Foreign Direct Investment in company (if any in %)**	
8.	**Shareholding pattern**	
9.	**Turn over as per Audited Balance Sheet for the preceding three years.** Year ____ Year ____ Year ____	
10.	**Annual budget for R&D during last three years (if any)** Year ____ Year ____ Year ____	
11.	**Income Tax returns for the preceding three years period** **Year ____** **Year ____** **Year ____**	

12.	**Nature of company** DPSU, Private Limited, Public Limited, Partnership, Proprietary, Ex- Serviceman Unit	
13.	**Category of industry** Large Scale, Medium Scale, Small Scale, Micro, Startup	
14.	**MSME Registration No**	
15.	**Certificates of registration as a manufacturing unit, if any.**	
16.	**If Startup, DPIIT Registration No**	
17.	**UDYOG AADHAR No**	
18.	**PAN Number**	
19.	**Details of Industrial license for defence manufacturing issued by DPIIT (if any)**	
20.	**Details of PESO license (if any)**	
21.	**GST Number**	
22.	**Nature of business** Manufacturing/ Sole Selling or Authorized Agent/ Assembler/ Traders/ Dealer/ Processor/ Repacker/ Others	
23.	**Details of current products and services** Products and services Supplied (please specify Govt/ Domestic market/ Export)	
24.	**Record of past performance** (e.g., Supply orders executed against of Ministry of Defence orders, Public Sectors and Paramilitary Forces, if any).	
25.	**Details of registration** with NSIC / SSI, DGS&D, other Defence Department, other Govt. Dept, membership of FICCI/ASSOCHAM/CII or other Industrial Association **(Attach relevant copies of registration letters)**	
26.	**Have you already taken any technology from DRDO** (If yes, give details attaching separate sheet)	

	Name of the Technology, Lab, Year, License number & Status	
27.	**ISO/ ISI certification or any other certification** (If yes, give details)	
28.	**Relevant clearances form the authorities/ ministries** (if any)	
29.	**Capacity and capability to undertake developmental work and to accept attendant financial and commercial risks.**	
30.	**Capacity/capability to market the product through the marketing network, sales and service network, reliability to maintain confidentiality.**	

PART-2

Infrastructure and other Information

1.	**Total area of factory** Covered (m^2), Uncovered (m^2), Bonded space available (m^2)	
2.	**Ownership of factory** Self-owned, partnership, rental	
3.	**Electric power** Sanctioned Installed Standby (if any)	
4.	**Availability of adequate infrastructure** (List of machines and their production capacities) and technical expertise	
5.	**Name of bank & A/c No Name of bank** A/c type A/c no Address of the bank Phone: Email:	

6. Details of current products:

S.No	Type	Description	Licensed/installed capacity	Annual production

				for preceding 3 years

7. Details of foreign collaboration, if any

S.No	Product	Name and address of collaborator	Year	Remarks

8. Details of products developed for services

S.No	Nomenclature of stores	Order No. and date	Remarks

9. Please give details of important facilities & infrastructure as per following format for:

(a) Production
(b) Unconventional, special m/c
(c) Testing & quality control facilities

S.No	Description of m/c	Make & model	Qty	Date of purchase	Remarks

10. Furnish the following details with relevant certificates and documents

(a) R&D facilities available :
(b) Inspection quality control of raw material components :
(c) Assistance from central agency for testing / calibration etc. :
(d) laboratory and drawing office facility :

11. Principal customers:

S. No	Name & address	S.O No and date	Date of last supply	Products supplied	Value

12. Future plans (if any) in respect of expansion programme/ installation of additional machines/ test facilities etc.

13. Name of the technology requested for transfer

(give self-assessment of your capability to absorb the technology)

14. Details of employee as on date on firm's pay roll

PERMANENT				
Category	Post Held	Number	Qualification	Total Service
Technical	Prod. Manager Q.C. Manager Supervisor Testing Staff (QC) Skilled workers Unskilled workers, etc			
Administrative	Purchase Manager Accounts Officer Office Superintendent Clerical Others, etc			

TEMPORARY				
Category	Post Held	Number	Qualification	Total Service
Technical	Prod. Manager Q.C. Manager Supervisor Testing Staff (QC) Skilled workers Unskilled workers, etc			
Administrative	Purchase Manager Accounts Officer Office Superintendent Clerical Others, etc			

DECLARATION :

I / we confirm that the information furnished in Part 1 & 2 above is correct. In the event of any information given by me / us is found incorrect / false at any time, I / we understand our EoI for ToT will be cancelled/ rejected without notice, beside any other appropriate action against me / us.

Industry seal

Authorized signatory

Name(s) in capital
Designation and seal of authorized signatory

Date:
Place:

Annexure - I

a) Memorandum and Articles of Association (Should be incorporated as per Indian Companies Act, as amended time to time)
b) Certificates of registration as a manufacturing unit, if any.
c) Audited Balance Sheet for the preceding three years.
d) Income Tax returns for the preceding three year period
e) Details of shareholding/ownership pattern especially foreign partners/ shareholders, foreign employees, directors, etc. The company must adhere to the prevailing Govt of India policies and regulations on Foreign Direct Investment (FDI)/DIPP norms as applicable.
f) Annual budget for R&D during last three years.
g) Numbers and details of IPR or patents, etc., held by the company.
h) Number of technically or professionally qualified personnel.
i) Record of past performance (e.g., Supply orders executed against of Ministry of Defence orders, Public Sectors and Paramilitary Forces, if any).
j) Availability of adequate infrastructure (List of machines and their production capacities) and technical expertise.
k) List of Testing and Support equipments
l) ISO/ ISI certification or any other certification
m) Relevant clearances form the authorities/ ministries (if any)
n) Capacity and capability to undertake developmental work and to accept attendant financial and commercial risks.
o) Capacity/capability to market the product through the marketing network, sales and service network, reliability to maintain confidentiality.
p) PESO and DPIIT license for explosive handling if ToT is for high energy Material, explosives, propellants, and component/ system dealing with it etc.
q) Under taking form company seeking ToT that none of its Directors, Independent Directors, non-executive Directors, Key management personnel are involved in any corrupt practices, unfair means and illegal activities.
r) Details of the industrial license for defence manufacturing to be provided by the industry seeking ToT.