

Process for Development of Hybrid Porous Materials for CO₂ Capture

The present technology aims at the development of novel hybrid adsorbent materials with high CO₂ removal efficiency for armed forces. Carbon dioxide (CO₂) is an anthropogenic agent which is considered to be a major contributor towards global warming. In the biosphere, equilibrium is maintained between carbon dioxide emission (anthropogenic activities) and intake (photosynthesis). Many technologies are used for the removal of CO₂ artificially. These include absorption, adsorption, microbial technologies, cryogenic and membrane-based technologies. However, in a confined environment, CO₂ removal is achieved with the help of sorbent beds. In such an environment, as the concentration of CO₂ increases it exhibits toxic effects. Under such circumstances, for long duration human operation, low concentration (0.5-1%) CO₂ removal becomes critical. Therefore, it is desired to have regenerative materials for CO₂ capture.

In this direction, DEBEL, has developed high CO₂ adsorption capacity regenerative solid sorbents. The material is a combination of inorganic, carbon and nitrogen-based precursors. The nature of these precursors, along with the textural parameters and surface chemistry of the porous materials is crucial for obtaining a controlled amount of surface amine functional groups. Careful manipulation of the experimental conditions could allow the formation of a thin layer of these nitrogen-containing groups on the surface as compared to the bulk of the material. The amount of nitrogen and the thickness of the nitrogen layer on the surface determines the efficacy of the hybrid materials towards the CO₂ adsorption and CO₂/N₂ selectivity. This implies that a high resistance towards adsorption of nitrogen without a significant compromise in the overall CO₂ adsorption capacity could be achieved.

It is envisaged that the developed sorbents should work as per the user defined specification. Indigenization of these sorbents will ensure development of a wide vendor base in India for future production.

Salient features:

- Hybrid porous materials for selective CO₂ capture
- The powders are pelletized with suitable binders with desired strength
- High CO₂ adsorption efficiency
- High CO₂/N₂ selectivity
- Regenerative sorbent

1. Interested Companies/industries are requested to apply against this EoI to the following address:-

**To,
The Director,
Defence Bio-Engineering & Electro Medical Laboratory(DEBEL)
CV Raman Nagar, Bangalore-560 093
Email- director.debel@gov.in
Phone:080-22502314
Fax No. 080-25282011**

2. A copy of interest may be sent to the following address without any attachment:-

**To,
The Director,
Directorate of Industry Interface & Technology Management (DIITM)
Room No. 447, DRDO Bhawan Rajaji Marg, New Delhi-110 011
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.

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:

List of Support documents to be attached with EoI

- (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 equipment's
 - (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 industrials license for defence manufacturing be provided by the industry seeking ToTs.
- (s) Application cum Industry Assessment Form.