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संस्थान



An Aided Institute of Department of Atomic Energy,
Government of India

इन्दिरा पुल के पास, भट, गांधीनगर - 382 428 भारत
दूरभाष: (079) 2396 2020/2021/2028
फैक्स: 91-079-23962277
वेब: www.ipr.res.in

NEAR INDIRA BRIDGE, BHAT
DIST. GANDHINAGAR - 382 428 (INDIA)
Phone: (079) 2396 2020/2021/2028
Fax : 91-079-23962277
Web : www.ipr.res.in

ENQUIRY

ENQUIRY NO : IPR/EQL/18-19/052
Date : 25-05-2018

Due on : 28-06-2018 by 1:00 PM IST

Reminder-1 Dt: 15-06-2018

Please send your offer in sealed envelope specifying Enquiry No, Date & Due Date, ALONG WITH your credentials for the following items:

Important Note:

Please note that e-mail quotations are not acceptable however you may send your queries (if any) to localpurchase@ipr.res.in

Please ensure your sealed quotation reaches this office not later than above mentioned due date and time.

Kindly go through the following documents properly before quoting which are available on the IPR web portal i.e., http://www.ipr.res.in/documents/tender_terms.html / attached herewith.

- 1) Instructions to the bidders & Terms and conditions (refer Form No: IPR-LP-01.V4)
- 2) Bidding format

GST for Goods and Services (IGST/CGST/SGST TAX BENEFITS): Please refer clause no: 8 of Form No: IPR-LP-01.V4

QUOTATION SHOULD BE ADDRESSED TO PURCHASE OFFICER ONLY

Sr No	Description	Quantity
1	Development of epoxy resin system for cryogenic application and deliverable as a product	4.0 Kgs

Note: Please quote with complete technical details (Technical compliance sheet and product data sheet).

Encl: As per attachment.

Sd/-

Mr. D. Ramesh
Purchase Officer-II

Information to Vendors: We are working towards a single platform for our future requirement. Hence, please refer IPR website i.e, <http://www.ipr.res.in/documents/tenderseng.html> for our future requirement.

Technical specification

The epoxy resin system is a mixture of two or three components, namely, Diglycidyl ether Bis-phenol-A (DGEBA) or Diglycidyl ether Bis-phenol-F (DGEBF) epoxy resin, toughening agents i.e. hardener and Silane coupling agent.

Epoxy Part 1 : DGEBA or DGEBF, Low viscosity multi-functional epoxy resins: 4 units by weight/optimized by vendor

- Viscosity at Room temp: 6000-26000 cps
- Epoxy equivalent weight: 185-210/ 0.30-0.35 (equivalent/100g) or optimized by vendor
- Colour: Yellow/others as per resin and hardener content

Epoxy Part 2: Hardener: Liquid aromatic amine hardener [Mixture of GY 051 (Poly condensation Aromatic amine Hardener) and DDM (4'-diaminodiphenyl Methane) in 2: 3 ratio mixture: **1 Units by weight/optimized by vendor**]

- Viscosity: 450-1000 m Pa-s
- Amine Value: 500-600 mg KOH/gram
- Toughening agent: IPBE (Isopropylidenebisphenol bis [2-glycidyoxy-3-n-butoxy]-1 Propylethens

Epoxy Part 3: KH-560 detail (Silane coupling agent): 0.2 part by weight/optimized by vendor
Chemical name of Silane coupling agent: Gamma-Amino Propyl Triethoxy Silane (C₂H₅O)₃SiC₃H₆NH₂

Note: The values given in above epoxy parts details are for reference only for development work, the vendor's epoxy parts of resin samples values may vary of final developed product. The final product will be accepted as per the performance tests to be done at IPR of point no. 7 of work order's terms and condition.

Mixed Resin Properties:

- Viscosity: 1000-3000 cps at 25 ° C/ optimized by vendor
- Curing Schedule of resin: 40 ° C- 1 Hr., 60 ° C- 1 Hr., 80 ° C- 1 Hr., 100 ° C- 2Hr (other curing schedule acceptable as per resin and hardener content)
- Tensile strength: At 300 K (Room temp): 57 MPa
At 77 K (-196 ° C, Liquid Nitrogen Temp): 75- 112 MPa
- Impact strength: At 300 K (Room temp): 14.25 MPa
At 77 K (-196 ° C, Liquid Nitrogen Temp): 19 MPa
- Shear strength: At 300 K (Room temp): 20.0MPa
At 77 K (-196 ° C, Liquid Nitrogen Temp): 19.49 MPa
At 4.2 K (-269 ° C, Liquid Helium temperature): 19.76 MPa
- Tensile modulus: 1-3 GPa
- Flexural strength: >150 MPa at 77 K
- Flexural modulus: 1-2 GPa
- Glass transition temperature T_g: 50-100 ° C
- Gel time of epoxy resin: ~1 hour/others also acceptable as per optimization by vendor
- Density: ~ 1.2 g/cm³
- Pot Life: (15-60 minutes)/optimized by vendor
- Tensile Lap shear strength of epoxy sample: 7-15 MPa or optimized by the vendor as per ASTM standard (in AL-AL metal or GFRP-GFRP samples)
- Flash point: > 95 °C
- Heat deflection temp: 50-60 °C
- Coefficient of thermal expansion: [30-40 in/in x 10⁻⁶/K]
- Water absorption (24 hrs): 0.02 %
- Hardness: >65 Shore D
- Minimum shelf life of resin, hardener and Silane coupling agent: 2 years/suggested by the vendor
- Dielectric strength: ≥ 7-10 kV/mm

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Note: The values given in above mixed resin properties details are for reference only for development work, the vendor's mixed epoxy resin samples values may vary of final developed product. The final product will be accepted as per the performance tests to be done at IPR of point no. 7 of work order's terms and condition.

Working condition of Epoxy Resin System

- Temperature range: 300 K -4.2 K
- Helium acceptable leak rate at 300 K, 77 K and 4.2 K : $\leq 1 \times 10^{-8}$ mbar l/s of bonded stainless steel and GFRP dissimilar material joints
- Excellent Thermal shock and thermal cycling resistance
- Adequate working life at room temperature
- High toughness at cryogenic temperature
- Very low shrinkage on cure: $\sim 3.88 \times 10^{-5}/K$
- Dissimilar material strong bonding (preferably, Stainless steel and GFRP)
- Long usable life and high toughness at cryogenic temperature
- Fracture toughness of epoxy resin system should be high by adding plasticizer.
- High crack resistance
- Low viscosity for good flow and penetration

Type of Work:

- The development of epoxy resin system for cryogenic applications and deliverable as a product.
- The vendor may have to supply several samples of epoxy resin to IPR till the desired performance and acceptance criteria are achieved.

Terms, Conditions and Scope of Work:

- (1) The vendor should be manufactures of epoxy resin system and should have basic understanding of cryogenic/low temperature conditions
- (2) The past working experience of epoxy resin for cryo application is preferable.
- (3) The vendor should have test facilities at LN₂ temperature. The following test is to be carried out at their R & D lab site before it sends to IPR
 - (a) Lap shear strength on AL-AL/GFRP-GFRP at sub-zero temperature using Liquid nitrogen
 - (b) Glass transition temperature by DMA
 - (c) Retention of modulus in bending mode at sub-zero temperature
 - (d) Processing characteristics like viscosity
 - (e) Tensile, compressive and inter-laminar shearing strength at 300 K and 77 K as per ASTM standard.
- (4) The vendor has to make samples of resin system as per the IPR requirement and testing at 77 K temperature at their lab witnessed by IPR representative.
- (5) If tests results are found in acceptable range then the sample is to be sent to IPR for further testing at 77 K and 4.2 K.
- (6) If the samples failed at vendor site, vendor has to make another sample and repeat the process of serial no.4.
- (7) The performance tests of the resin samples will be conducted at IPR for final acceptance of epoxy resin system.
 - (a) The helium leak tightness of dissimilar materials (SS+GFRP) : $\leq 1 \times 10^{-8}$ mbar-l/s
 - (b) Thermal cycles: 5 nos., 300 K to 77 K & reverse using LN₂ fluid
 - (c) Helium leak tightness at 77 K and 4.5 K in pressure (0-20) bar (g) condition: : $\leq 1 \times 10^{-8}$ mbar-l/s of bonded joints of developing resin system
- (8) No extra charges will be applicable for making numbers of epoxy resin samples and testing at 77 K to vendor.
- (9) The vendors have to provide their payment terms and conditions, the part payment toward this work order is recommended.

Done

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- (10) The expiry period of the epoxy resin system should be provided by the vendor.
 - (11) The development task and final product of epoxy resin system should be completed within 3-4 months or suggested by the vendor.
 - (12) The vendor has to provide the MSDS (Material Safety Data Sheet) and technical details of each resin sample to be submitted to IPR.
 - (13) By mutual understanding with vendor that all the technical information of developing epoxy resin system should be known to IPR and it is recommended not to disclose any manufacturing details to others.
 - (14) The patent and sale of final developed product could be done by mutual agreement with IPR, rules, regulations and norms of the company.

Technical Compliance Form

Sr. No.	Particulars	IPR Requirement	Vendor's Specification
1.	<p>The development of epoxy resin system for cryogenic applications and deliverable as a product.</p>	<p>1. The development of epoxy resin system for cryogenic applications and deliverable as a product.</p> <p>2. The vendor may have to supply several samples of epoxy resin to IPR till the desired performance and acceptance criteria are achieved.</p> <p>3. <u>Epoxy Resin System details</u></p> <p>Epoxy Part 1 : DGEBA or DGEBF, Low viscosity multi-functional epoxy resins: 4 units by weight/optimized by vendor</p> <ul style="list-style-type: none"> ▪ Viscosity at Room temp: 6000-26000 cps ▪ Epoxy equivalent weight: 185-210/ 0.30-0.35 (equivalent/100g) or optimized by vendor ▪ Colour: Yellow/others as per resin and hardener content <p>Epoxy Part 2: Hardener: Liquid aromatic amine hardener [Mixture of GY 051 (Poly condensation Aromatic amine Hardener) and DDM (4'-diaminodiphenyl Methane) in 2:3 ratio mixture: 1 Units by weight/optimized by vendor]</p> <ul style="list-style-type: none"> ▪ Viscosity: 450-1000 m Pa-s ▪ Amine Value: 500-600 mg KOH/gram ▪ Toughening agent: IPBE (Isopropylidenebisphenol bis [2-glycidylloxy-3-n-butoxy]-1 Propylethanes <p>Epoxy Part 3: KH-560 detail (Silane coupling agent): 0.2 part by weight/optimized by vendor</p> <p>Chemical name of Silane coupling agent: Gamma-Amino Propyl Triethoxy Silane (C₂H₅O)₃ SiC₃H₆NH₂</p>	
		<p>Note: (The values given in above epoxy parts details are for reference only for development work, the vendor's epoxy parts of resin samples values may vary of final developed product. The final product will be accepted as per the performance tests to be done at IPR of point no. 7 of work order's terms and conditions)</p> <p><u>Mixed Resin Properties:</u></p> <ul style="list-style-type: none"> ▪ Viscosity: 1000-3000 cps at 25 ° C/ optimized by vendor ▪ Curing Schedule of resin: 40 ° C- 1 Hr., 60 ° C- 1 Hr., 80 ° -1 Hr., 100 ° C- 2 Hr (other 	

	<p>curing schedule acceptable as per resin and hardener content)</p> <ul style="list-style-type: none"> ▪ Tensile strength: At 300 K (Room temp): 57 MPa At 77 K (-196 ° C, Liquid Nitrogen Temp): 75- 112 MPa ▪ Impact strength: At 300 K (Room temp): 14.25 MPa At 77 K (-196 ° C, Liquid Nitrogen Temp): 19 MPa ▪ Shear strength: At 300 K (Room temp): 20.0MPa At 77 K (-196 ° C, Liquid Nitrogen Temp): 19.49 MPa At 4.2 K (-269 ° C, Liquid Helium temperature): 19.76 MPa ▪ Tensile modulus: 1-3 GPa ▪ Flexural strength: >150 MPa at 77 K ▪ Flexural modulus: 1-2 GPa ▪ Glass transition temperature Tg: 50-100 ° C ▪ Gel time of epoxy resin: ~ 1 hour/others also acceptable as per optimization by vendor ▪ Density: ~ 1.2 g/cm3 ▪ Pot Life: (15-60 minutes)/optimized by vendor ▪ Tensile Lap shear strength of epoxy sample: 7-15 MPa or optimized by the vendor as per ASTM standard (in AL-AL metal or GFRP-GFRP samples) ▪ Flash point:> 95 ° C ▪ Heat deflection temp: 50-60 ° C ▪ Coefficient of thermal expansion: [30-40 in/in x 10⁻⁶/K] ▪ Water absorption (24 hrs): 0.02 % ▪ Hardness: >65 Shore D ▪ Minimum shelf life of resin, hardener and Silane coupling agent: 2 years/suggested by the vendor ▪ Dielectric strength: ≥7-10 kV/mm <p>Note: The values given in above mixed resin properties details are for reference only for development work, the vendor's mixed epoxy resin samples values may vary of final developed product. The final product will be accepted as per the performance tests to be done at IPR of point no. 7 of work order's terms and conditions.</p>
	<ol style="list-style-type: none"> 4. The vendor should be manufactures of epoxy resin system and should have basic understanding of cryogenic/low temperature conditions 5. The past working experience of epoxy resin for cryo application is preferable

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	<p>6. The vendor should have test facilities at LN₂ temperature. The following test is to be carried out at their R & D lab site before it sends to IPR</p> <ul style="list-style-type: none"> (a) Lap shear strength on AL-AL/GFRP-GFRP at sub-zero temperature using Liquid nitrogen (b) Glass transition temperature by DMA (c) Retention of modulus in bending mode at sub-zero temperature (d) Processing characteristics like viscosity (e) Tensile, compressive and inter-laminar shearing strength at 300 K and 77 K as per ASTM standard. 	
	<p>7. The vendor has to make samples of resin system as per the IPR requirement and testing at 77 K temperature at their lab witnessed by IPR representative.</p>	
	<p>8. If tests results are found in acceptable range then the sample is to be sent to IPR for further testing at 77 K and 4.2 K.</p>	
	<p>9. If the samples failed at vendor site, vendor has to make another sample and repeat the process of serial no.7.</p>	
	<p>10. The performance tests of the resin samples will be conducted at IPR for final acceptance of epoxy resin system.</p> <ul style="list-style-type: none"> (a) The helium leak tightness of dissimilar materials (SS+GFRP) : $\leq 1 \times 10^{-8}$ mbar-l/s (b) Thermal cycles: 5 nos., 300 K to 77 K & reverse using LN₂ fluid (c) Helium leak tightness at 77 K and 4.5 K in pressure (0-20) bar (g) condition: $\leq 1 \times 10^{-8}$ mbar-l/s of bonded joints of developing resin system 	
	<p>11. The expiry period of the epoxy resin system should be provided by the vendor.</p>	
	<p>12. The development task and final product of epoxy resin system should be completed within 3-4 month or suggested by the vendor.</p>	
	<p>13. The vendor has to provide the MSDS (Material Safety Data Sheet) and technical details of each resin sample to be submitted to IPR</p>	
	<p>14. By mutual understanding with vendor that all the technical information of developing epoxy resin system should be known to IPR and it is recommended not to disclose any manufacturing details to others.</p>	
	<p>15. The patent and sale of final developed product could be done by mutual agreement with IPR, rules, regulations and norms of the company.</p>	

(Bidder's Sign with Official Stamp)