

TECHNOLOGY COLLABORATION PROGRAMME (TCP)

EUWP ANNUAL BRIEFING TEMPLATE

TCP NAME	Report Date
Advanced Materials for Transportation (AMT)	03/09/2023

Main Technology Policy Messages/Recommendation

- Explore, discover, and put into practice critical material technologies to enable the development of the technologies.
- Advanced materials are foundational technologies, especially during the transition to low-carbon fuels
- Expanding material technology development to support the carbon emission lifecycle and electrification.
- Explore materials compatibility for low-carbon fuels and hydrogen
- Capture critical and sustainable materials data that impacts technologies

Achievements (recent developments in the last year only)

- Strategic work plan has been accepted by IEA Secretariat, additional details still required
- Restructured Annex VIII – to include
 - Task 1: Thermal management
 - Task 2: Ultra-conductive materials
- Hosted a Virtual Workshop of Electrical Conductivity Measurements (Thermoconductivity of solid materials)
- Initiated Annex XII: Tailored Engineered Surfaces
- Initiated Annex XIII: Low Carbon Fuels and 4 new tasks
 - Task 1: GREET+ model
 - Subtask 1a – GREET+ model
 - Subtask 1b – Lightweighting of BEVs (Dr. Liddell’s presentation)
 - Subtask 1c – Medium-duty truck technology assessment
 - Subtask 1d – Heavy duty truck technology assessment
 - Subtask 1e – Critical materials
 - Task 2: Advanced materials for Hydrogen
 - Led by Germany, will collaborate with Hydrogen TCP
 - Task 3 (new) - Carbon capture and utilization
 - Task 4 (new) - Green chemistry and sustainable materials

Outlook to the Future (optional)

- Annex VIII – Thermoelectric Materials
 - Aluminum based materials for thermal management applications: battery packs and charging stations
- Annex XII – Tailored Engineered Surfaces
 - Surface impacts on tire wear (pavement, street, road)
 - Microplastics impact on the environment

Dissemination and publications (other than ExCo meetings and workshops included below)

- IEA Critical Minerals TCP Coordination Group, Summary of first meeting, December 8, 2022
- Annex XIII, Task 1a/1b “The Role of Electric Vehicle Lightweighting in Transportation Sector Decarbonization: A Top-down LCA Approach,” paper linked to website, January 2023
- Organize workshops (first will be late spring/early summer 2023) to discuss how to share/disseminate information.

Collaboration and Co-operation

Other IEA network TCPs and co-ordination groups

- AMT TCP participated in the IEA Critical Minerals TCP Coordination Group – Dec 2022
 - More than 15 group performing critical minerals work including TCPs on: Electric Vehicles (EV), Hybrid Electric Vehicles (HEV), Batteries and Hydrogen (H2)
 - Investigating using webpage to share information

- Created the Automotive Applications working group
- Multi-year roadmap is being developing with USCAR (first meeting held 3/8/2023) which will include demand for critical materials

IEA secretariat

- AMT Annex XIII has a strong alignment with Bioenergy TCP Task 39, members are collaborating
- AMT Annex XIII: Task 2 is collaborating with Combustion TCP on hydrogen combustion

Membership

- Membership expanded by one to 10 member countries, with one additional country currently acting as a temporary member
 - Austria has joined AMT as of April 1, 2022.
 - Brazil has joined the AMT as of December 2022
 - Received inquiries from South Africa, Singapore and Thailand for information and procedures for possible participation to join AMT
- Invitation letter requested to add additional research member from member country Australia
 - Commonwealth Scientific and Industrial Research Organisation (CSIRO)
- Draft letter prepared to add additional research member from member country China
 - Shanghai Polytechnic University
- Under consideration to add additional research member from member country China
 - Hefei University of Technology
- Open to considering other research entities.

Management

- ExCo Meeting held January 17-19, 2023 (Virtual) to finalize strategy
- AMT leadership position elections held at this meeting, all elected by unanimous vote
 - AMT Chair: Jerry Gibbs
 - AMT Vice Chair Americas: Kumar Sadayappan
 - AMT Vice Chair Asia: Shengqiang Bai
 - AMT Vice Chair Europe: Carsten Gachot
 - AMT Secretary: Michelle Avillanoza
- Annex task managers elected all by unanimous vote
 - Annex VIII: Thermoelectric Materials – Hsin Wang
 - Annex XI: Automotive Glazing - YS Yoon
 - Annex XII (NEW): Tailored Engineered Surfaces – Carsten Gachot
 - Annex XII (NEW): Low Carbon Fuels – Roberto Souza
- ExCo next meeting is scheduled for June 28-30 in Vienna, Austria
- ExCo meets semiannually to develop and evaluate ideas for new tasks, and to conduct a progress assessment of ongoing tasks.

MEETINGS OR WORKSHOPS

Latest ExCo meetings			
Place	Date	Place	Date
Virtual meeting	1/17/2023-1/19/2023	Hybrid (Vienna)	6/28/2023-6/30/2023

FUTURE ANNEX OR TASK MEETINGS

Annex/Task	Place	Date
Annex VIII: Thermoelectric Measurement Virtual Workshop of Electrical Conductivity Measurements	TBD	2023

CLOSED ANNEXES

Name	Objectives / key deliverables	Launch/end dates	Participants	Key learnings
Annex IV: Friction Reduction Surface Technology	Investigate technologies that could potentially increase fuel economy by 5-7% (combined) when fully adopted	20xx / 2019	Australia, China, Israel, South Korea, UK, US	<p>Developed a low-cost surface texture fabrication technique to facilitate possible commercialization.</p> <p>Verified the use of diamond-like-carbon (DLC) coatings that extend texture life.</p> <p>Verified the use of ultralow viscosity lubricants to improve fuel economy.</p>
Annex V: Advanced Corrosion Protection Technologies for Structural Magnesium	Advanced corrosion protection technologies for structural magnesium alloys used in transportation industry	2009 / 2012	Canada, China, Germany, US	A cost-effective cold spray coating was developed that showed successful corrosion control of magnesium alloys when used as automotive parts. This removes a major hurdle for the use of magnesium alloys in automotive application, lowering the weight of the vehicles
Annex VI: Carbon Fibers and Composites	Identify gaps in international standards and test methods	2009 / 2013	UK, US	AMT assessed the feasibility and means whether it is appropriate to develop the standards. Gaps in international standards and test methods were identified. The development and acceptance of appropriate standard test techniques were vital to promote widespread adoption.
Annex VII: Nanomaterials	Develop, evaluate and standardize methods for testing mechanical properties of nanomaterials.	2009 / 2013	Canada, China, Germany, Israel, UK, US	The Annex staff determined to be impractical to reach the desired objectives due to technical barriers to achieve a precision statement.
Annex IX: Model-based Coatings	Integrate computational material engineering modeling with coating testing to develop advanced energy efficiency and	2012/ 2021?	Australia, China, Israel, Finland, UK, US	Multiscale computational material science models revealed that surface roughness, coating defects played a crucial role in initiating microcracks leading to surface damage and higher frictions.

	durability coatings in engines			
Annex X: Multi-materials Joining	Develop novel joining methods and improve joint mechanical and corrosion properties	2013 / 2021	Canada, Germany, South Korea, US	<p>Identified 5 standard materials for joining tests. The materials identified for testing were high strength steel sheet, aluminum sheet, magnesium sheet, and 2 carbon fiber composites.</p> <p>Evaluated conventional and unconventional joining methods such as refill friction-stirred spot welding, braze-welding, friction bit joining, ultrasonic welding, and friction self-piercing riveting, etc.</p> <p>Standardized joint types, sample sizes and shapes, and mechanical testing methods.</p> <p>More than 30 unique combinations of materials and joining methods were evaluated and results were shared with industry and stored in a database.</p>

ONGOING ANNEXES

Name	Objectives / key deliverables	Launch/end dates	Participants	Key learnings so far
Annex VIII: Thermal management	Develop thermoelectric materials for waste heat recovery in transportation industries.	2009 / 2028	Australia, Canada, China, Germany, South Korea, US	Material/device/system level integration strategies are needed to optimize thermoelectric, phase change material (PCM), thermal interface material (TIM) and other relative materials to manage thermal inputs.
Annex XI: Automotive Glazing	Develop material specifications for automotive glass replacement materials, test method development and standardization of test methods	2017 / 2028	China, South Korea	Replacing glass with lighter weight polycarbonate-based materials and various coatings to improve the optical and UV resistance. Test methods and standards are also being developed.
Annex XII: Tailored Engineered Surfaces	Explore multiscale, multifunctional surface treatments for self-adjusting	2021 / 2028	Australia, Austria, Brazil, China, Israel, South Korea, UK, US	Identifying reliability improvement applications.

	surfaces to maximize energy efficiency			<p>Assessing new coating concepts using Selenides with nano-Se-powder and MXenes.</p> <p>Assess new lubricant materials by using computational approaches to combinatorial materials tribology. Model assessment using polycrystalline CuNi alloys.</p>
Annex XIII: Low Carbon Fuels	Examine the effect of materials on low carbon fuels (biofuels, ammonia, eFuels, hydrogen, etc.) performance during power generation cycles.	2022 / 2028	Brazil, US	Establish engine testing protocols baseline (starting with biofuels) and seek industrial participation to access other fuel sources. Facilitate transition to low carbon fuels to reduce carbon emissions.

PLANNED ANNEXES

Name	Expected Objectives / key deliverables	Launch date	Potential Participants	Main planned activities
None	N/A	N/A	N/A	N/A