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Technology, Economics and Strategy of Recycling Polymeric Materials

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Strategy: Integrating gaseous CO2 into recycled PET via ethylene-carbonate monomer to make the high-value-added polymers

2018-8-7 Taiwan News 〈時評〉循環經濟 - 小循環vs.大循環以解決海洋塑膠汙染問題: (林江珍、謝國煌 / 台大教授)
塑膠汙染海洋問題需要改變策略，跳脫廢物再生之[小循環經濟]思惟，依循大自然存在化學轉換法之[大循環]，才能根本解決。

- https://www.taiwannews.com.tw/ch/news/3501261

Title: Circular Economics: small recycling vs. large recycling for solving the problem of Plastics Waste in Ocean (by Professors JJ Lin and KH Shieh)

Abstract: The seriousness of the plastic waste in ocean will not be solved by the current “small recycling” system. Instead, a new system of “large recycling” based on Polyester chemistry is proposed.

A paradigm change is needed to shift from Polyolefins to Polyesters in a economically feasible manner is urgently needed.

Conclusion:
Circular Economics — Recycling Polymeric Materials

Why PET?

(polyester vs. polyolefin)

(hydrolysis and biodegradability)

Technology

process feasibility proven and patented

A. Chemical Conversion (trans-esterification) to a number of products

B. by EC (carbonate) exchange reaction to PCPE, TPEcE …

Economics

(a host of applications)

(1) TPEE elastomers

(2) For PU industry (new polyols)

(3) For Nylon 6T egineering plastics

- ---integrating r-PET chemical recycling and CO2-derived polymers to solve the world problem: ---

  TCCT (Taiwan Carbon–Credit Technology)

台灣轉型之缺鏈: 關鍵材料之供應鏈與關鍵技術之深耕
(從過去之長處轉型至能參與[未來世界產業體]之關鍵)

Mapping 台灣關鍵材料產業

—從奈米材料分散之案例說起—

Mapping Taiwan future key materials' industry

林 江 珍

(JJ Lin)

「近代工程技術討論會」METS
Nov 11, 2014

National Taiwan University

JJ Lin Labs, Polymer Institute

Nanotechnology, Dispersants and Applications
(JJ Lin 2001-2019)-- 分散技術為所有奈米材料應用之關鍵--

技術/材料之擴展 --點、線、面、體
傳統至前瞻科技產業之大趨勢

Conventional Polymers (commodity and specialty)

1. PET (fiber/bottle/film)
2. Polyamides (Nylon 6,6…)
3. Polyolefins (PE, PP, SEBS, EPDM)
4. PMMA and polyacrylates
5. PU
6. PI
7. Epoxy
8. PC … blends/alloys
9. Resins, Films…

Polymeric Dispersants

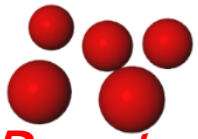
SMA-Jeffamine amines

PTT (branched polyester-polyols)

POEM (POE-imide-amide)

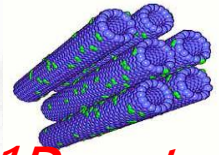
POEU (POE-PU)

Dispersion Technology



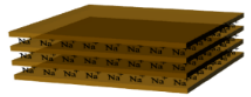
0D-material

AgNP, Pt, TiO_2, ZnO, CuO, SiO_2, Fe2O3, RGB…



1D-material

CNT…



2D-material

NSP, Clay, Graphene GO

- Hardness and gas/water barrier
- thermal stability
- thermal conductivity
- electric conductivity
- Antimicrobial surface
- anti-flame, fire-retardants, anti-heat
- super-hydrophobic and anti-fouling surface

Electronic and Solar Cells

- Quasi-solid and polymer electrolytes
- DSSC (transparent/flexible/performance)
- New display and flexible/ transparent/ high Tg

[天然奈米矽片]之發明與其多元應用
Versatile applications of the Natural Nano Silicate Platelets (NSP)

複合材料：阻氣、低熱脹係數、硬度、耐磨、耐燃/耐熱/阻熱、表面抗菌/超疏水、抗靜電、低介電 (Dk/Df)
Nanocomposite/Polymer additives：Gas barrier (PET), CTE, Hard Coating, Anti-abrasive, Fire-retardant/Anti-flame,
Anti-statics, Surface anti-microbial/self-cleaning, Low K)

新型分散劑
New dispersants (I/O)
for nanoparticles,
pigments, 螢光粉, etc.

抗火焰膜/塗料/耐燃劑
Inorganic/Organic (I/O)
film for
anti-flame film/coating,
and
fire-retardant additives

水處理
(吸附菌/毒素/農藥/重金屬)
Water-Treatment:
Absorbents for bacteria,
toxins, insecticides, heavy
metals, etc.

農業植物/畜牧/漁業
抗菌及防病蟲害
取代農藥/抗生素
Insecticide-free and Antibiotics-free agriculture/livestock/soil:
Anti-bacteria, -fungi, -virus for
crop/seed/environment

個人衛生/家庭/環境用
清潔劑/防霉/抗蚊蟲/除臭劑
Household & Heavy-duty
Detergents; de-odorants, etc.

癌細胞醫療: 藥物標靶載体
Nano-carriers for targeting
cancer cells