

應用於水面上之光驅動轉子

Light-driven Rotors Applied to a Water Surface

專利證號

I725554

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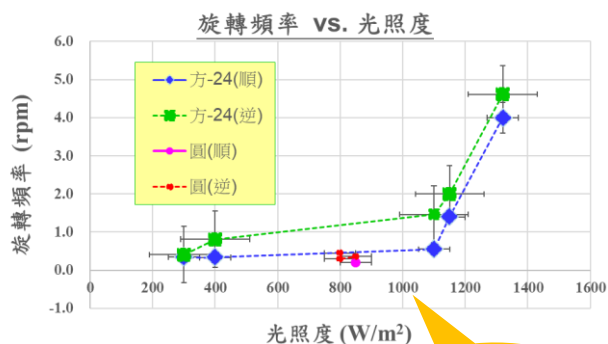
關鍵詞：光驅動、表面張力、太陽能馬達

產業課題/技術特色

本發明透過獨特的多層式設計，將性質各異的通俗材料有效地搭配整合在一起，進而一舉實現了材料成本低廉、結構簡單耐用、製作和維修都很方便省時等量產和普及化所需的優勢，並且只需在足量日光直接照射之下的水面上即可驅動運轉，因而可望成為汲取太陽能源的另一種有效途徑。

技術摘要

本發明的組成包括：絕熱性佳的剛性基板、導熱性佳的可撓屈金屬箔片，和最上層的優良吸光材料。最上方的表面積得以充分吸收光線，再將產生的熱能經由金屬箔片的傳導而加熱各角落的同側水面，因此造成該處的表面張力受熱而變小，進而有效地提供了驅動基板旋轉所需的合力矩。透過大型化或集結成群，應可實現不同方式的技術應用。

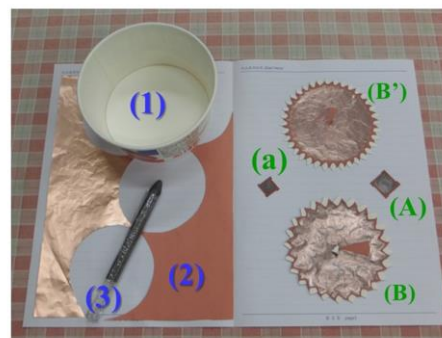


商品化價值

地球表面
正午的平均
日光照度

本發明首度提供一個設計架構，可以只靠足量日光的直接照射而使得簡單的漂浮物體旋轉，並且其轉速會隨著照度的提高而增加，因此其實際應用的潛力至少可以包括：

1. 各級學校關於自然科學和能源教育的啟發性實作教材及新穎太陽能玩具。
2. 光驅動馬達：透過大型化或集結整合的傳動設計，而實現「帶動發電」等應用。
3. 養殖農漁業設備：日光帶動的漂浮轉盤，提供攪水增氧或間歇遮蔽等功能。(c),(d)
4. 景觀工程/庭園造景器材：為戶外的靜態水池設施點綴動態的日光裝置藝術。(e)
5. 簡易型日光照度計：先經過校正，即可透過轉速的測量而估算日光的照度。



- (1) 速食麵紙碗底盤
直徑 ~ 11 cm
- (1') 蓋玻片(玻璃或塑膠)
邊長 ~ 18 或 24 mm
- (2) 電解用銅箔(單面粗糙)
厚度 ~ 35 μ m
- (3) 9B 素描用鉛筆

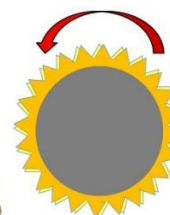
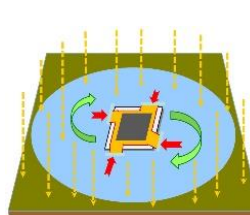


- (a) 小正方形轉子
18 mm X 18 mm
- (A) 大正方形轉子
24 mm X 24 mm
- (B) 24齒圓形轉子
直徑 ~ 11 cm
- (B') 36齒圓形轉子
直徑 ~ 11 cm

材料成本(單價下限)的概略估算

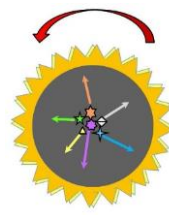
$$(1') + (2) + (3) = (a) \text{ or } (A) < \text{NT\$ } 10$$

$$(1) + (2) + (3) = (B) \text{ or } (B') < \text{NT\$ } 50$$

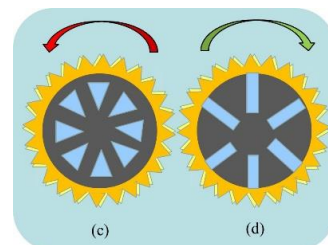


(a)

(b)



(c)



(c)

(d)



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Light-driven Rotors Applied to a Water Surface

Keywords: light-driven, surface tension, solar motor

Innovatory value

This invention is based on a simple design of a few-layered structure for the floating rotors made of several common materials with distinct properties. The products are not only **low-cost** and **easy-to-manufacture/maintain** for **popularization**, but have also achieved a **continuous rotational motion under direct sunlight** (without being concentrated by lens) for the first time, which imply an alternative way to harvest the **solar energy**.

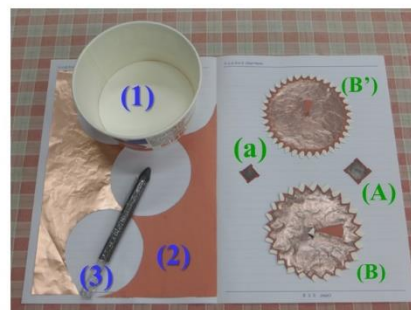
Functionality and practicability

The three major components in this layered-structure include a **rigid plate of poor thermal conductivity** (to serve as a floating platform), a **flexible metal foil of good thermal conductivity**, and a source of graphite (e.g., a charcoal pencil) to provide the **effective light-absorbing material**. Upon exposed to direct sunlight, the solar energy absorbed by the graphite layer is conveyed by the metal foil to the water at their contact sites. As the water gets heated at these rotationally asymmetrical contact sites, the local **surface tension** is reduced, leading to a non-zero resultant torque that causes the rotational motion.

Commercialization and marketability

Based on the proposed framework to design a floating object for a **continuous rotation under direct sunlight** and the observed **speed-up with increased light intensity**, the potential applications of this invention include:

1. The cost-effective hand-made packages for school children in their education on science/energy. .
2. Alternative approach to generation of mechanical power by solar energy.
3. Instruments in agriculture/fishery to modulate local sunlight exposure in fish ponds dynamically. (c),(d)
4. Devices of landscape architecture to provide ponds in a park/ garden with dynamical lighting shows. (e)
5. Portable power meters of sunlight upon calibration between the rotating speed and the light intensity.



- (1) Cardboard base plate
diameter ~ 11 cm
- (1') Cover-slip (glass / plastic)
length ~ 18 或 24 mm
- (2) Copper foil (roughened)
thickness ~ 35 μm
- (3) charcoal pencil



- (a) small square rotor
18 mm X 18 mm
- (A) large square rotor
24 mm X 24 mm
- (B) 24-toothed disk rotor
diameter ~ 11 cm
- (B') 36-toothed disk rotor
diameter ~ 11 cm

estimated cost of materials per rotor

$$(1') + (2) + (3) = (a) \text{ or } (A) < \text{NT\$ } 10$$

$$(1) + (2) + (3) = (B) \text{ or } (B') < \text{NT\$ } 50$$

