TSCFA台灣超臨界流體協會
Taiwan Supercritical Fluid Association

電子報第 210 期

活動訊息

- ***第23屆超臨界流體技術應用與發展研討會暨113年度會員大會***
  時間：2024年**10月18日(五)**
  地點：高雄蓮潭國際會館R102會議室
- ***Supergreen 2024 (The 13th International Conference on Supercritical Fluids)***
  時間：2024年**11月29日-12月1日**
  地點：韓國首爾
- ***14 th ISSF(International Symposium on Supercritical Fluids)& 9th ISHA (International Solvothermal and Hydrothermal Association Conference)***
  日 期 ： **JUNE 15-20, 2025**
  地 點 ： Bali, Indonesia
  CHAIR： JAEHOON KIM, SOUTH KOREA
  Scientific Meetings – ISASF (supercriticalfluidsociety.net)
  ※協會將組團由理事長帶隊前往，屆時歡迎會員踴躍參加！

淨零永續

- 產業節能減碳資訊網 INDUSTRIAL ENERGY SAVING AND CARBON REDUCTION INFORMATION WEB
  https://ghg.tgpf.org.tw/
- 淨零永續學校
  https://college.itri.org.tw/nzschool/

團體會員介紹

- 子嘉企業有限公司

教育訓練班

- (日間班)高壓氣體特定設備操作人員安全衛生教育訓練班 10/21~10/25
- (夜間班)高壓氣體特定設備操作人員安全衛生教育訓練班 11/05~11/17

技術文摘

- Advancing Fundamental Understanding of Retention Interactions in Supercritical Fluid Chromatography Using Artificial Neural Networks: Polar Stationary Phases with –OH Moieties (使用人工神經網路增進對超臨界流體色譜中滯留交互作用的基本理解：帶有 –OH 部分的極性固定相)

- Maximized Lanthanide Extraction Using Supercritical CO_2 and Fluorinated Organophosphate Extractants (使用超臨界 CO_2 和氟化有機磷酸酯萃取劑最大限度地萃取鑭系元素)
- Mechanical property enhancement of flax fibers via supercritical fluid treatment (透過超臨界流體處理增強亞麻纖維的機械性能)
- Protocols for the preparation and characterization of decellularized tissue and organ scaffolds for tissue engineering (組織工程去細胞組織和器官支架的製備和表徵方案)
- Pyrolysis Mechanism and Reservoir Simulation Study of Organic-Rich Shale during the In Situ Conversion via Supercritical Water Heating (富有機質頁岩超臨界水加熱原位轉化熱裂解機制與儲層模擬研究)
- Supercritical CO_2 and Subcritical H_2O Analysis Instrument: Automated Lipid Analysis for In Situ Planetary Life Detection (超臨界 CO_2 和亞臨界 H_2O 分析儀器：用於原位行星生命探測的自動脂質分析)
- Towards sustainable energy – exploring the supercritical carbon dioxide (S-CO_2) Brayton cycle for various applications: a critical review (邁向永續能源—探索超臨界二氧化碳 (S-CO_2) 布雷頓循環的各種應用：嚴格檢視)

台灣超臨界流體協會
電話：(07)355-5706　E-mail：tscfa@mail.mirdc.org.tw

親愛的 TSCFA 會員 您好：

台灣超臨界流體協會謹訂於民國 113 年 10 月 18 日(星期五)，假高雄蓮潭國際會館 R102 會議室，舉辦「第 23 屆超臨界流體技術應用與發展研討會」，並於當日下午 16 時舉行 113 年度會員大會。 恭請

蒞臨指導

技術研討會暨年會籌備會主任委員 **梁明在理 事 長**

副主任委員 **蘇至善副理事長**

台灣超臨界流體協會 全體理監事暨籌備會委員 **敬邀**

研討會議程

時間	議程內容		
09:30~10:00	報到		
10:00~10:10	開幕式（主任委員致歡迎詞/貴賓致詞）		
10:10~11:00	**【大會演講 I】** Biomass Utilization Using Supercritical Fluids	**演講人：** **Prof. Jaehoon Kim** Sungkyunkwan University	**主持人：** **蘇至善教授** 國立台北科技大學化學工程與生物科技系
11:00~11:50	**【大會演講 II】** Supercritical Fluids Process for Nanomaterials and Its Application Toward Carbon-Neutral Chemical Industry	**Prof. Takaaki Tomai** Tohoku University	
11:50~12:30	Poster 英文簡報評選(3min/人)		
12:30~13:30	午餐		
13:30~14:00	**邀請演講(I)** Supercritical CO_2/Green Solvent Biphasic System as a New Sustainable Solvent for Different Applications: Insights into The Mechanism of Molecular Interaction	**演講人：** **Ardila Hayu Tiwikrama 助理教授** 國立台北科技大學化學工程與生物科技系	**主持人：** **吳弦聰教授** 明志科技大學化學工程系
14:00~14:30	**邀請演講(II)** 超臨界流體發泡射出成形技術的視覺化	**演講人：** **葉樹開教授** 國立台灣科技大學材料科學與工程系	
14:30~15:00	**邀請演講(III)** 缺陷鈍化技術開發與物理機制研究應用於先進半導體元件	**演講人：** **陳柏勳助理教授** 國立中山大學半導體及重點科技研究學院	
15:00~16:00	海報論文展示及廠商展示區交流/茶敘		
15:30~16:00	會員大會報到		
16:00~16:05	理事長致詞		
16:05~16:35	會務報告		
16:35~16:45	第 11 屆理監事選舉		
16:45~17:10	提案討論		
17:10~17:40	**邀請演講(IV)** 亞果出任務-組織工程再生醫學的未來發展	**演講人：** **謝達仁執行長** 亞果生醫(股)公司	**主持人：** **郭子禎秘書長**
	理監事選舉開票作業		
17:40~17:50	宣佈第 11 屆理監事當選名單		
17:50~18:00	前往晚宴餐廳		
18:00~20:00	晚宴、頒贈捐助廠商感謝狀、研究論文優良及佳作獎		

※如因不可抗拒因素，本會保有活動內容變更調整之權利

子嘉企業有限公司

關於子嘉

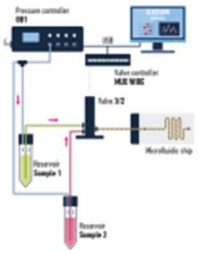
本公司創立於民國 73 年，主要代理及經銷歐、美、日各國知名工業用及實驗室量測儀錶設備，主要產品包括製程成份分析儀、氣體偵測器、校正器、壓力及流量量測儀錶等類。

本著專業、誠信、服務、品質、創新、永續經營之企業精神,

提供各類客戶專業的儀錶規劃及全面的銷售服務。

- 製程成份分析儀(PROCESS COMPONENTS ANALYZER)
- 氣體偵測器(GAS DETECTOR)
- 校正器(INSTRUMENTS CALIBRATOR)
- 壓力量測儀錶(PRESSURE INSTRUMENTS)
- 流量量測儀錶(FLOW INSTRUMENTS)
- 零配件洩漏/阻塞檢測系統(LEAKAGE TESTER)

產品資訊



微流體流量壓力控制系統

微量液體定量幫浦 / 齒輪 / 蠕動 / 注射針式

氣體流量計 / 質量流量控制器 / RMA 浮子流量計

科里奧質量 / 超音波 / 齒輪 / 電磁 / 葉輪流量計

風速 / 風量量測儀器

真空 / 微壓 / 差壓 / Dwyer 2000 差壓計

壓力、液位、料位開關 / 傳送器 / 控制器

儀表校正儀器 (流量、壓力、溫度)

氣體分析儀 (O_2,CO, CO_2, VOC,THC, H_2) 手提式鍋爐煙道廢氣分析儀

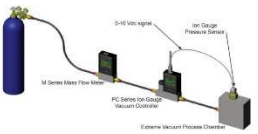
[可燃性 / 毒性氣體偵測器
空氣品質偵測儀]

[溫濕度傳送器 / 資料記錄器]

[流量、壓力、零件氣密、
IP67 防水測漏儀器]

行業應用

[氣體質量流量計/質量流量
控制器應用]

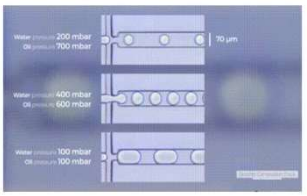


[真空/壓力控制器應用]

[壓力校正應用]

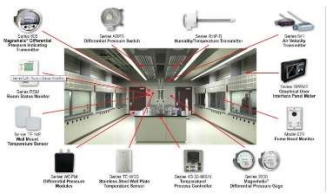
[流量校正應用]

[微量液體定量充填幫浦應用]



[微流體生醫晶片壓力真空流量
控制系統應用]

[Coriolis 科里奧微量液體
質量流量計控制器應用]



[DWYER 產品應用]

零件氣密洩漏測試
/IP65/66/67/68 防水測漏應用

[鍋爐煙道排放廢氣分析儀]

聯絡資訊

EMAIL：sales@sinom.com.tw　　LINE ID：0980225526
台北公司 (新北市 248013 五股區中興路 4 段 33 號)
TEL：(02)2292-0001　　FAX：(02)2292-0199
高雄公司 (高雄市 800012 新興區中正三路 93 號 10 樓)
TEL：(07)281-4799　　FAX：(07)261-3443

TSCFA台灣超臨界流體協會
Taiwan Supercritical Fluid Association

(日間班)高壓氣體特定設備操作人員安全衛生教育訓練班

需要有操作證照的單位，歡迎向協會報名。

●上課日期：**113/10/21~10/23 08:00~17:00；10/24~10/25 08:00~17:00(實習)**

●上課時數：高壓氣體特定設備操作人員安全衛生教育訓練課程時數 35 小時＋2 小時(測驗)。

●課程內容：高壓氣體概論 3HR、種類及構造 3HR、附屬裝置及附屬品 3HR、自動檢查與檢點維護 3HR、安全裝置及其使用 3HR、操作要領與異常處理 3HR、事故預防與處置 3HR、安全運轉實習 12HR、高壓氣體特定設備相關法規 2HR，共 35 小時。(另加學科測驗 1 小時及術科測驗約 1~2 小時)

●上課地點：高雄市楠梓區高楠公路 1001 號【金屬工業研究發展中心研發大樓 2 樓　產業人力發展組】

●參加對象：從事高壓氣體特定設備操作人員或主管人員。

●費　　用：本班研習費**新台幣 7,000 元整**，**本會會員享九折優惠**。

●名　　額：每班 30 名，額滿為止。

●結訓資格：期滿經測驗成績合格者，取得【高壓氣體特定設備操作人員安全衛生訓練】之證書。

●報名辦法：1.傳真報名：(07)355-7586台灣超臨界流體協會
2.報名信箱：tscfa@mail.mirdc.org.tw
3.研習費請電匯至 兆豐國際商銀 港都分行(代碼017)
戶名：社團法人台灣超臨界流體協會 帳號：002-09-018479（註明參加班別及服務單位）或以劃線支票抬頭寫「台灣超臨界流體協會」連同報名表掛號郵寄台灣超臨界流體協會，本會於收款後立即開收據寄回。

※洽詢電話：(07)355-5706 吳小姐繳交一吋相片一張及身份證正本

報　　名　　表

課程名稱	高壓氣體特定設備操作人員安全衛生教育訓練			上課日期	113 年 10/21~10/25	
姓　　名	出生年月日	身份證字號	手機號碼	畢業校名		公司產品
服務單位				電　　話		
服務地址	□□□			傳　　真		
發票住址	□□□			統一編號		
負 責 人	人	訓練聯絡人 / 職稱		email：		
參加費用	共　　元	參加性質		□公司指派　　□自行參加		
繳費方式	□郵政劃撥　□支票　□附送現金			報名日期	年　　月　　日	

※ 出生年月日、身份證字號、畢業校名、電話、地址須詳填，以利製作證書。

上課日期時間表

課程名稱：(日間班)高壓氣體特定設備操作人員安全衛生教育訓練班

2024/10/21 (一)	08:00 ~ 17:00
2024/10/22 (二)	08:00 ~ 17:00
2024/10/23 (三)	08:00 ~ 17:00
2024/10/24 (四)	08:00 ~ 17:00 (實習第 1 組)
2024/10/25 (五)	08:00 ~ 14:00 (實習第 1 組)

TSCFA 台灣超臨界流體協會
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(夜間班)高壓氣體特定設備操作人員安全衛生教育訓練班

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●上課日期：**(夜班)11/05~11/14 18:30~21:30；11/16~11/17 08:00~17:00(實習)**

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3.研習費請電匯至 兆豐國際商銀 港都分行(代碼017)
戶名：社團法人台灣超臨界流體協會 帳號：002-09-018479（註明參加班別及服務單位）或以劃線支票抬頭寫「台灣超臨界流體協會」連同報名表掛號郵寄台灣超臨界流體協會，本會於收款後立即開收據寄回。

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報　　名　　表

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姓　　名	出生年月日	身份證字號	手機號碼	畢業校名		公司產品
服務單位				電　　話		
服務地址	□□□			傳　　真		
發票住址	□□□			統一編號		
負 責 人	人	訓練聯絡人 / 職稱		email：		
參加費用	共　　元	參加性質		□公司指派　　□自行參加		
繳費方式	□郵政劃撥　□支票　□附送現金			報名日期	年　　月　　日	

※ 出生年月日、身份證字號、畢業校名、電話、地址須詳填，以利製作證書。

上課日期時間表

課程名稱：(日間班)高壓氣體特定設備操作人員安全衛生教育訓練班

2024/11/05 (一)	18:30 ~ 21:30
2024/11/06 (二)	18:30 ~ 21:30
2024/11/07 (三)	18:30 ~ 21:30
2024/11/08 (四)	18:30 ~ 21:30
2024/11/11 (五)	18:30 ~ 21:30
2024/11/12 (一)	18:30 ~ 21:30
2024/11/13 (二)	18:30 ~ 21:30
2024/11/14 (三)	18:30 ~ 21:30
2024/11/16 (六)	08:00 ~ 17:00 (實習第 1 組)
2024/11/17 (日)	08:00 ~ 14:00 (實習第 1 組)

Advancing Fundamental Understanding of Retention Interactions in Supercritical Fluid Chromatography Using Artificial Neural Networks: Polar Stationary Phases with –OH Moieties

使用人工神經網路增進對超臨界流體色譜中滯留交互作用的基本理解：帶有 –OH 部分的極性固定相

By **Kateřina Plachká, Veronika Pilařová, Tat'ána Gazárková, František Švec, Jean-Christophe Garrigues, Lucie Nováková***

Department of Analytical Chemistry, Faculty of Pharmacy in Hradec Králové, Charles University, 500 05 Hradec Králové, Czechia

Abstract

The retention behavior in supercritical fluid chromatography and its stability over time are still unsatisfactorily explained phenomena despite many important contributions in recent years, especially focusing on linear solvation energy relationship modeling. We studied polar stationary phases with predominant –OH functionalities, i.e., silica, hybrid silica, and diol columns, and their retention behavior over time. We correlated molecular descriptors of analytes with their retention using three organic modifiers of the CO_2-based mobile phase. The differences in retention behavior caused by using additives, namely, 10 mmol/L NH_3 and 2% H_2O in methanol, were described in correlation to analyte properties and compared with the CO_2/methanol mobile phase. The structure of >100 molecules included in this study was optimized by semiempirical AM1 quantum mechanical calculations and subsequently described by 226 molecular descriptors including topological, constitutional, hybrid, electronic, and geometric descriptors. An artificial neural networks simulator with deep learning toolbox was trained on this extensive set of experimental data and subsequently used to determine key molecular descriptors affecting the retention by the highest extent. After comprehensive statistical analysis of the experimental data collected during one year of column use, the retention on different stationary phases was fundamentally described. The changes in the retention behavior during one year of column use were described and their explanation with a proposed interpretation of changes on the stationary phase surface was suggested. The effect of the regeneration procedure on the retention was also evaluated. This fundamental understanding of interactions responsible for retention in SFC can be used for the evidence-based selection of stationary phases suitable for the separation of particular analytes based on their specific physicochemical properties.

資料來源：https://doi.org/10.1021/acs.analchem.4c01811

Maximized Lanthanide Extraction Using Supercritical CO_2 and Fluorinated Organophosphate Extractants

使用超臨界 CO_2 和氟化有機磷酸酯萃取劑最大限度地萃取鑭系元素

By **Yuemin Deng, Dong Xia, Damien Bourgeois, Daniel Meyer, Stéphane Campidelli, Hélène Isnard, Victor Francois, Robin Ronceray, Bertrand Reygner, Jean-Christophe P. Gabriel***

Université Paris-Saclay, CEA, CNRS, NIMBE, LICSEN, 91191 Gif-sur-Yvette, France

SCARCE Laboratory, Energy Research Institute, Nanyang Technological University, 50 Nanyang Drive, 639798 Singapore, Singapore

Abstract

Rare-earth elements (REEs) are critical to the production of modern integrated electronic devices that are ubiquitous in our lives. They are also of strategic importance to our economy and security. Unfortunately, although electronic waste contains such elements, its overall low concentration makes its recovery economically impractical, posing a significant challenge to recycling efforts. Hence, this paper proposes changes to the extraction process that focus on the potential for economically viable recovery. In addition, it also reduces the environmental impact of downstream hydrometallurgical processes. More precisely, this study presents novel extraction molecules that exhibit exceptional solubility and extraction efficiencies in supercritical carbon dioxide. This development therefore provides an alternative process to traditional hydrometallurgical processes that is more environmentally friendly and addresses the urgent need for sustainable methods of REE recovery and separation.

Keywords: *maximized lanthanide extraction, supercritical carbon dioxide, fluorinated organophosphate extractants, rare-earth elements, hydrometallurgy*

資料來源：https://doi.org/10.1021/acssusresmgt.4c00122

Mechanical property enhancement of flax fibers via supercritical fluid treatment

透過超臨界流體處理增強亞麻纖維的機械性能

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Abstract

The desire for lightweight, carbon-negative materials has been increasing in recent years, particularly as the transportation sector reduces its global carbon footprint. Natural fibers, such as flax fiber and their composites, offer a compelling combination of properties including low density, high specific strength, and carbon negativity. However, because of the low modulus and high variability in performance, natural fibers can't compete with glass fibers as structural reinforcements in polymer composites. In this study, flax technical fibers were treated in supercritical CO_2 ($scCO_2$), and the effects of this treatment on the morphology and properties of flax fibers are reported. Treatment in $scCO_2$ successfully resulted in higher fiber modulus and strength by 33% and 40%, respectively. Fiber porosity was reduced by 50% and morphological changes to the fibers were observed. Specifically, fiber lumen collapsed during treatment and micro/mesoporosity was reduced by 27%. Treated flax fibers were used to create 30 vol% unidirectional flax-epoxy composites. $ScCO_2$ treatment raised composite modulus and strength by 33% and 25%, respectively. Because of the dependence between technical fiber size and mechanical properties, the relationship between fiber modulus and fiber size were created and applied to the rule-of-mixtures. This relationship were found to be viable representations of the fiber performance within each composite. Overall, the treatment developed in this study has the potential to significantly improve natural fiber properties, enabling their consideration for use in lightweight, semi-structural composites.

資料來源：https://www.nature.com/articles/s41598-024-69105-z

Protocols for the preparation and characterization of decellularized tissue and organ scaffolds for tissue engineering

組織工程去細胞組織和器官支架的製備和表徵方案

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Abstract

Extracellular matrix (ECM) scaffolds are extensively used in tissue engineering studies and numerous clinical applications for tissue and organ reconstructions. Due to the global severe shortage of human tissues and organs, xenogeneic biomaterials are a common source for human tissue engineering and regenerative medicine applications. Traditional methods for decellularization often disrupt the 3D architecture and damage the structural integrity of the ECM scaffold. To efficiently obtain natural ECM scaffolds from animal tissues and organs with intact architecture, we have developed a platform decellularization process using supercritical CO_2 and tested its potential application in tissue engineering. A combination of human mesenchymal stem cells with a decellularized dermal matrix scaffold allowed complete regeneration of skin structure in a porcine full-thickness wound model.

Keywords: 3D bioprinting; decellularized tissue scaffolds; organ regeneration; organ scaffolds; porcine organs; porcine tissues; regenerative medicine; supercritical carbon dioxide; tissue engineering; tissue regeneration.

資料來源：https://pubmed.ncbi.nlm.nih.gov/33307815/

Pyrolysis Mechanism and Reservoir Simulation Study of Organic-Rich Shale during the In Situ Conversion via Supercritical Water Heating

富有機質頁岩超臨界水加熱原位轉化熱裂解機制與儲層模擬研究

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Abstract

The low-medium maturity shale reservoir has garnered substantial interest because of its huge reserves and promising hydrocarbon generation potential. In this paper, a self-designed high-temperature and pressure pyrolysis experiment device was constructed. Experiments involving thermogravimetric pyrolysis and isothermal pyrolysis in supercritical water (SCW) environments were carried out on samples from the Longkou shale. The effect of SCW on organic-rich shale pyrolysis was understood by comparing the product characteristics of shale pyrolysis in SCW environments with dry environments. The complete kinetic models of kerogen pyrolysis in dry and SCW environments were established by fitting the composition characteristics of pyrolysis products using the nonlinear least-squares method. The numerical simulation of shale in situ conversion via SCW injection and electrical heating was investigated, and the performance evolution of thermal-reactive flow coupling was clarified. The results showed that SCW reduced the main temperature window of kerogen pyrolysis, and the total mass loss increased by 46.29% compared to that in a dry environment. SCW promoted the generation and subsequent release of pyrolysis hydrocarbons. SCW altered the compositional profile of the generated products, mainly by increasing CO_2 content in pyrolysis gas, reducing olefin content, and effectively improving oil quality compared with the dry environment. SCW reduced the activation energy of kerogen pyrolysis by 41.65%, indicating that the reaction is more easily activated. More hydrocarbon products and less coke were generated. The superiority of kinetic models holds significant practical implications for the application of SCW heating organic-rich shale in situ conversion technology. The shale in situ conversion via SCW greatly shortened the production cycle and improved cumulative oil. Kerogen within the interwell region was completely

pyrolyzed, the reservoir porosity increased to 2 times of the original value, and permeability was enhanced by 10 times after shale in situ conversion via SCW for 3 years.

資料來源：https://doi.org/10.1021/acs.energyfuels.4c02100

Supercritical CO_2 and Subcritical H_2O Analysis Instrument: Automated Lipid Analysis for In Situ Planetary Life Detection

超臨界 CO_2 和亞臨界 H_2O 分析儀器：用於原位行星生命探測的自動脂質分析

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Abstract

The search for extraterrestrial extant or extinct life in our Solar System will require highly capable instrumentation and methods for detecting low concentrations of biosignatures. This paper introduces the Supercritical CO_2 and Subcritical H_2O Analysis (SCHAN) instrument, a portable and automated system that integrates supercritical fluid extraction (SFE), supercritical fluid chromatography (SFC), and subcritical water extraction coupled with liquid chromatography. The instrument is compact and weighs 6.3 kg, making it suitable for spaceflight missions to planetary bodies. Traditional techniques, such as gas chromatography–mass spectrometry (MS), face challenges with involatile and thermally labile analytes, necessitating derivatization. The SCHAN instrument, however, eliminates the need for derivatization and cosolvents by utilizing neat supercritical CO_2 with water as an additive. This SFE-SFC-MS method gives efficient lipid biosignature separations with median detection limits of 10 pg/g (ppt) for fatty acids and 50 pg/g (ppt) for sterols. Several free fatty acids and cholesterol were among the detected peaks in biologically lean samples from the Atacama Desert, demonstrating the instrument's potential for in situ life detection missions. The SCHAN instrument addresses the challenges of conventional systems, offering a compact, portable, and spaceflight-compatible tool for the analysis of organics for future astrobiology-focused missions.

資料來源：https://doi.org/10.1021/acs.analchem.4c00474

Towards sustainable energy – exploring the supercritical carbon dioxide (S-CO_2) Brayton cycle for various applications: a critical review

邁向永續能源—探索超臨界二氧化碳（S-CO_2）布雷頓循環的各種應用：嚴格檢視

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Abstract

In recent years, with an increase in energy demand and environmental concerns, it is important to generate the required amount of energy in a greener and more efficient way. The supercritical carbon dioxide (S-CO_2) based Brayton cycle is gaining attention due to its efficient energy generation. In the present study, a detailed review is provided on the S-CO_2 Brayton cycle. This includes thermodynamic properties, general comparison of various Brayton cycle configurations, and so on. The applications of integrating the S-CO_2 Brayton cycle in power generation, nuclear, fuel cell, and renewable energy are also discussed in detail. The key challenges that arise from the technology and their improvements are provided. In addition, test facilities around the world are outlined and future goals are explored. Furthermore, a practical dimension to the S-CO_2 Brayon cycle system also emphasises the national and international relevance and collaborative nature of advancements in this field. It provides a roadmap for further research and development, emphasising the importance of this technology in addressing both energy demands and environmental concerns. Overall, as compared to other cycles, the S-CO_2 Brayton cycle exhibits the maximum efficiency, which is approximately 53%, achieved at a turbine inlet temperature exceeding 1173.15 K.

Keywords: *Solar thermal power generation, concentrating solar power, super critical CO_2, Brayton cycle, renewable energy, turbomachinery*

資料來源：https://doi.org/10.1080/01430750.2024.2378046