

# RSC Sustainability

rsc.li/rscsus

The Royal Society of Chemistry is the world's leading chemistry community. Through our high impact journals and publications we connect the world with the chemical sciences and invest the profits back into the chemistry community.

## IN THIS ISSUE

ISSN 2753-8125 CODEN RSSUAN 2(5) 1167–1622 (2024)



**Cover**  
See Michael M. Lerch, Ben L. Feringa *et al.*, pp. 1300–1336. Image reproduced by permission of A. Guinart and T. Freese from *RSC Sustainability.*, 2024, 2, 1300.



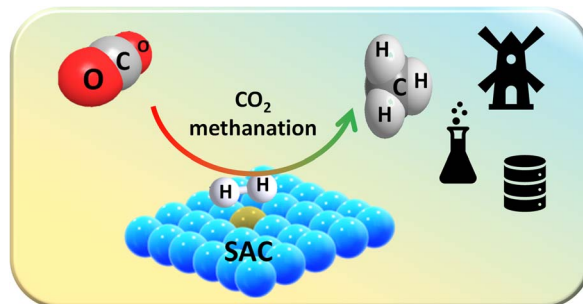
**Inside cover**  
See Iseult Lynch *et al.*, pp. 1378–1399. Image reproduced by permission of Iseult Lynch from *RSC Sustainability.*, 2024, 2, 1378.

## CRITICAL REVIEWS

1179

### Recent advances in CO<sub>2</sub> hydrogenation to methane using single-atom catalysts

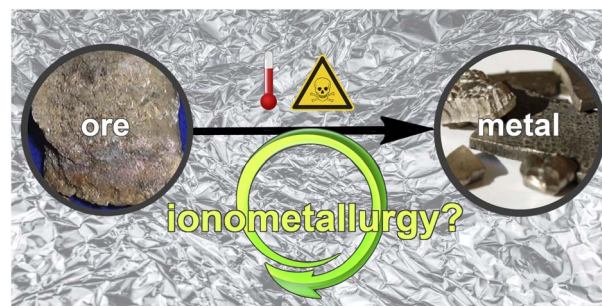
Neha Choudhary, Kallayi Nabeela, Nirmiti Mate and Shaikh M. Mobin\*



1202

### Ionometallurgy: an academic exercise or promising approach?

Janine Richter and Michael Ruck\*



# Advance your career in science

with professional recognition that showcases  
your **experience, expertise and dedication**

## Stand out from the crowd

Prove your commitment  
to attaining excellence in  
your field

## Gain the recognition you deserve

Achieve a professional  
qualification that inspires  
confidence and trust

## Unlock your career potential

Apply for our professional  
registers (RSci, RSciTech)  
or chartered status  
(CChem, CSci, CEnv)

## Apply now

[rsc.li/professional-development](https://www.rsc.li/professional-development)



1215

## Electrophilic aromatic substitution in eutectic-type mixtures: from an old concept to new sustainable horizons

Tatiana Martí, Xavier Marset,\* Celia Guillem, Diego J. Ramón and Gabriela Guillena\*

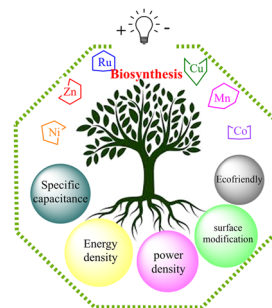
### Sustainable $S_EAr$ in Eutectic-type Mixtures



1224

## Green supercapacitors: review and perspectives on sustainable template-free synthesis of metal and metal oxide nanoparticles

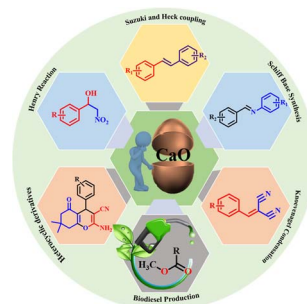
Jayaprakash Meena, Shapna shankari Sivasubramaniam, Ezhumalai David and Santhakumar K\*



1246

## Biogenic derived egg shell and its derivatives as solid base heterogeneous catalysts for organic transformations: a comprehensive review

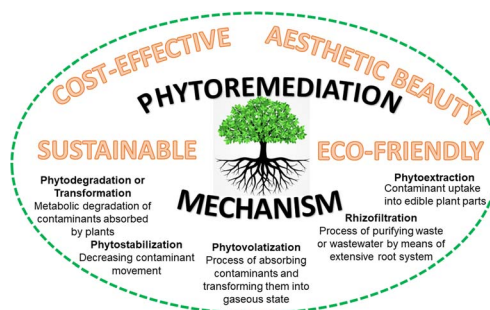
Nagaraj S. Naik,\* Swathi Divakar, Jyothi M. S., Srinivasa Budagumpi, R. Geetha Balakrishna and Mahesh Padaki\*



1269

## Phytoremediation as a green and sustainable prospective method for heavy metal contamination: a review

Md. Merajul Islam,\* Neha Saxena and Deepa Sharma



## TUTORIAL REVIEW

1289



### The Sea's best kept secret: the use of seaweed as a source of biohydrogen for clean and renewable energy

Olivia M. Wyper, Sohrab Zendejboudi and Francesca M. Kerton\*

## PERSPECTIVES

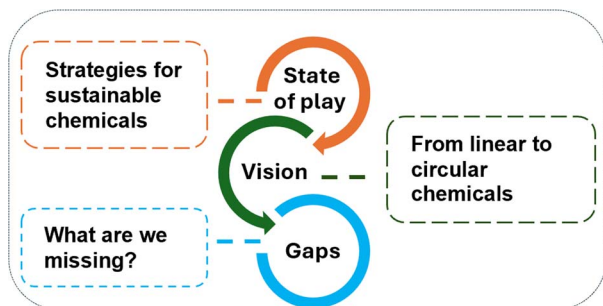
1300



### The relevance of sustainable laboratory practices

Thomas Freese, Nils Elzinga, Matthias Heinemann, Michael M. Lerch\* and Ben L. Feringa\*

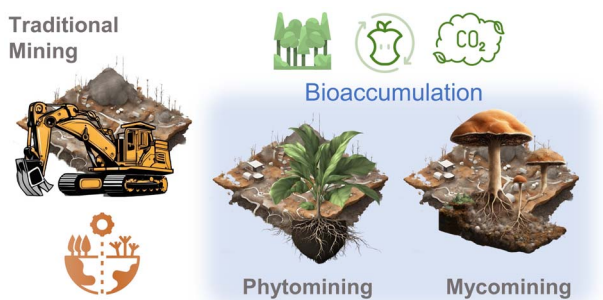
1337



### The pathway to net zero: a chemicals perspective

Matthew Royle, Benoît Chachuat, Bing Xu and Elizabeth A. Gibson\*

1350



### Mycomining: perspective on fungi as scavengers of scattered metal, mineral, and rare earth element resources

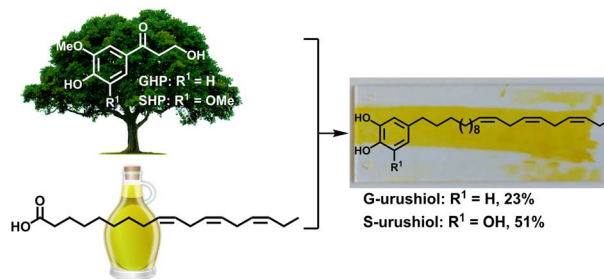
Mitchell P. Jones\* and Alexander Bismarck\*



1358

### Synthetic urushiols from biorenewable carbon resources: chemical conversion of enzymatic degradation products of wood lignin to an ancient yet future coating material

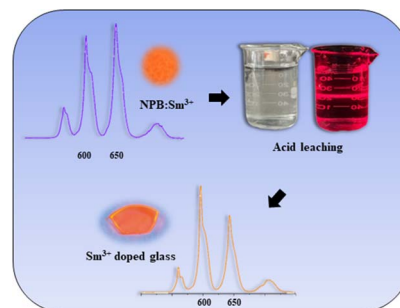
Katsuhiro Isozaki,\* Hiroshi Matsuda, Ryosuke Agata, Jaeyoung Jeon, Beiling Wu, Francesca Pincella, Makoto Ikenaga, Yoichi Tachibana, Yukari Ohta and Masaharu Nakamura\*



1363

### Phosphate-based phosphor for the urban mining of lanthanides: a case study of samarium

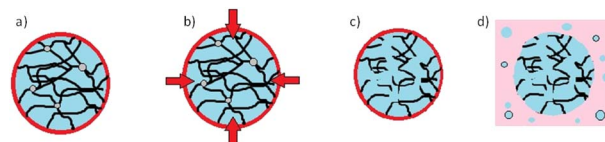
Yonglin Chen, Haoyi Wu\* and Yihua Hu\*



1367

### Maximizing polypropylene recovery from waste carpet feedstock: a solvent-driven pathway towards circular economy

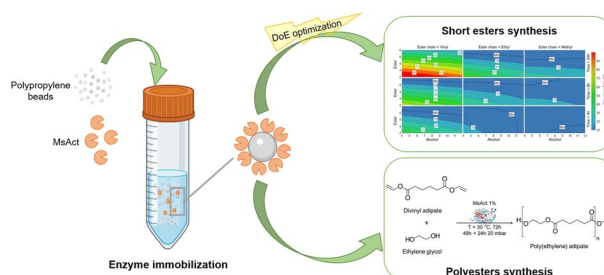
Heider Salazar, Ioan-Alexandru Baragau, Zhen Lu, Luis A. Román-Ramírez and Suela Kellici\*



1372

### *Mycobacterium smegmatis* acyltransferase catalyzes the synthesis of esters and polyesters

Filippo Fabbri, Ilaria Vergani, Silvia Donoso, Luca Nespoli, Valeria Marisa Rocca, Lisa Moni, Georg M. Guebitz, Martina Letizia Contente and Alessandro Pellis\*



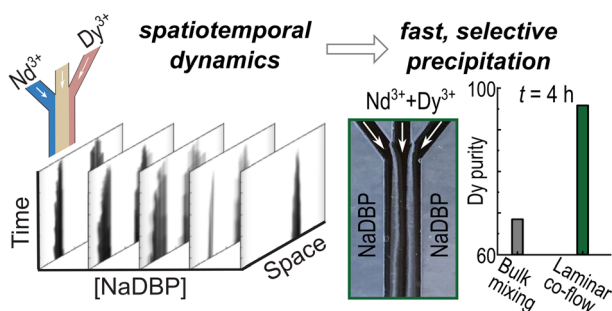
1378



## The role of FAIR nanosafety data and nanoinformatics in achieving the UN sustainable development goals: the NanoCommons experience

Beatriz Alfaro Serrano, L. Cristiana Gheorghe, Thomas E. Exner, Susanne Resch, Clemens Wolf, Martin Himly, Andreas Falk, Nathan Bossa, Socorro Vazquez, Anastasios G. Papadiamantis, Antreas Afantitis, Georgia Melagraki, Dieter Maier, Haralabos Saramveis, Egon Willighagen, Vladimir Lobaskin, Jonathan D. Oldfield and Iseult Lynch\*

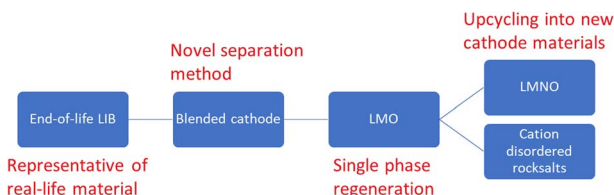
1400



## Flow-driven enhancement of neodymium and dysprosium separation from aqueous solutions

Qingpu Wang and Chinmayee V. Subban\*

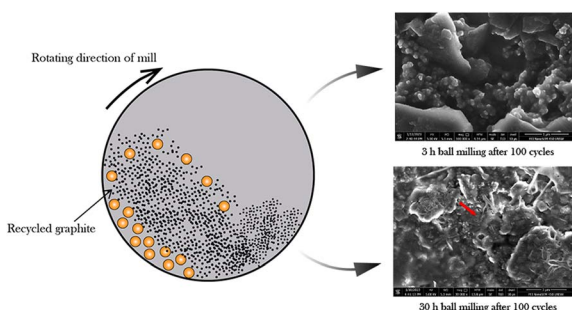
1408



## Upcycling of low value end-of-life cathode material into next generation cathode materials

R. Madge,\* A. Jarvis, W. Lima da Silva, L. L. Driscoll, P. A. Anderson and P. R. Slater

1418



## Spent graphite from lithium-ion batteries: re-use and the impact of ball milling for re-use

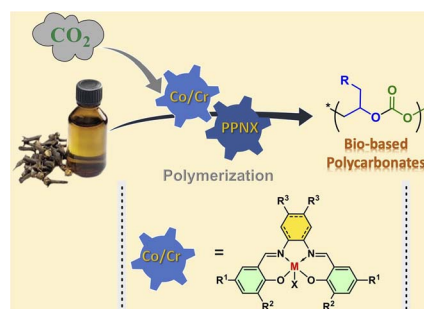
Jian Peng, Stefanie Maslek and Neeraj Sharma\*



1431

## Facile synthesis of polycarbonates from biomass-based eugenol: catalyst optimization for selective copolymerization of CO<sub>2</sub> and eugenol to achieve polycarbonates

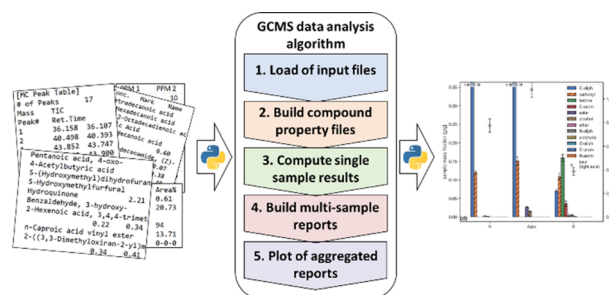
Mani Sengoden, Gulzar A. Bhat,\* Tristan Roland, Chia-Min Hsieh and Donald J. Darensbourg\*



1444

## Open-source Python module to automate GC-MS data analysis developed in the context of bio-oil analyses

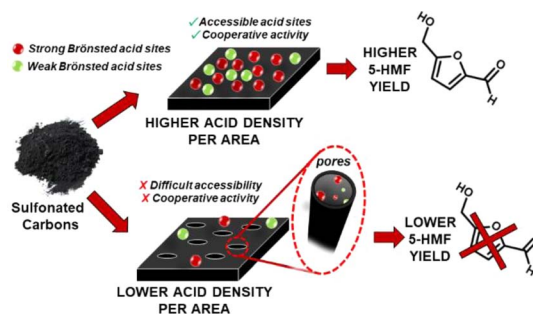
Matteo Pecchi\* and Jillian L. Goldfarb



1456

## Tailored sulfonated carbons: unraveling enhanced catalytic dynamics for fructose dehydration under conventional and microwave heating

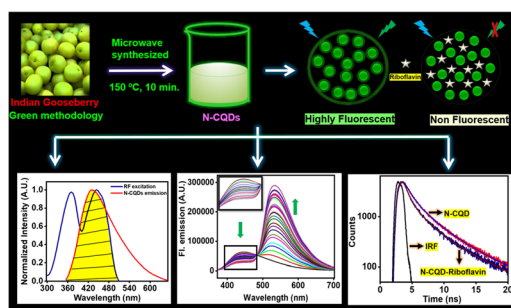
Gabrielle Mathias Reis, Letícia Ferreira Lima Machado, Renan Silva Nunes, Dalmo Mandelli and Wagner Alves Carvalho\*



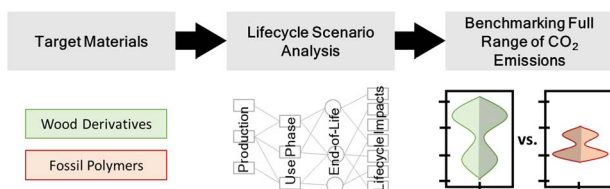
1472

## Green transformation of biomass-derived Indian gooseberry into fluorescent intrinsic nitrogen-functionalized carbon quantum dots for real-time detection of vitamin B<sub>2</sub> in the nanomolar range

Mandeep Kaur, Mily Bhattacharya\* and Banibrata Maity\*



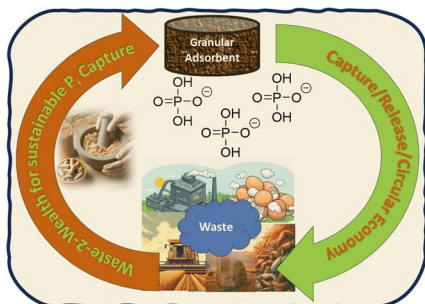
1487



### Unraveling the climate neutrality of wood derivatives and biopolymers

Akshat Sudheshwar, Kealie Vogel, Gustav Nyström, Nadia Malinverno, Monica Arnaudo, Carlos Enrique Gómez Camacho, Didier Beloin-Saint-Pierre, Roland Hischer and Claudia Som\*

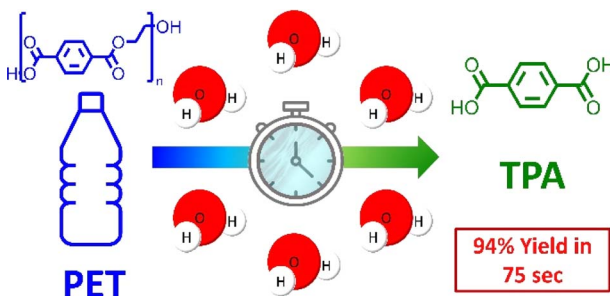
1498



### Eggshell incorporated agro-waste adsorbent pellets for sustainable orthophosphate capture from aqueous media

Bernd G. K. Steiger, Nam T. Bui, Bolanle M. Babalola and Lee D. Wilson\*

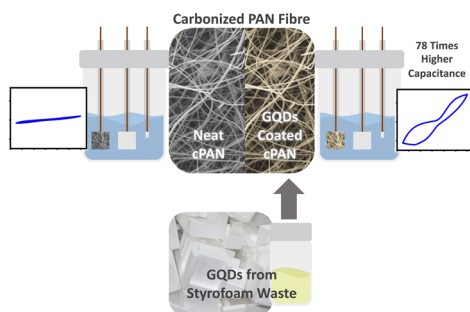
1508



### Fast hydrolysis for chemical recycling of polyethylene terephthalate (PET)

Patrícia Pereira, Willem Slear, Angelo Testa, Kevin Reasons, Peter Guirguis, Phillip E. Savage\* and Christian W. Pester\*

1515



### GQD-PAN-based high-performance supercapacitor: an approach towards wealth from waste

Dheeraj Kumar, Ekta Vashishth, Sweetly Rani, Advitiya Kumar, Bhanu Nandan, Supreet Singh Bahga and Rajiv K. Srivastava\*

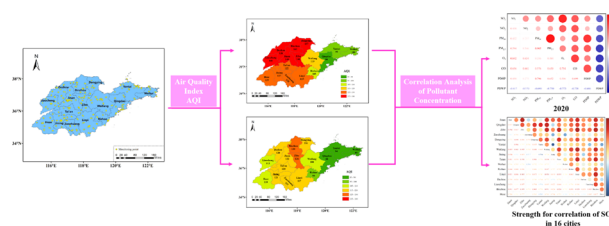




1528

## Spatial and temporal differentiation of air quality and its influence factors in 16 cities in Shandong Province from 2019 to 2020

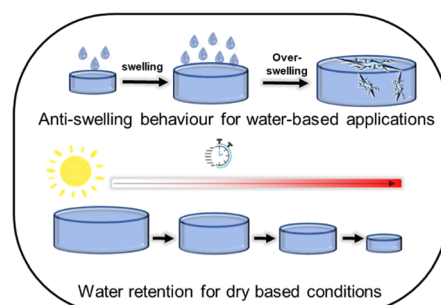
Ziheng Wan, Chuanxi Yang,\* Xiaoning Wang,\* Yan Xue, Jianai Zhao, Jiayi Cui, Qianqian Guo, HuiJuan Hua, Haofen Sun, Dong Chen, Weihua Zhao, Yihua Xiao and Weiliang Wang\*



1543

## Cellulose nanocrystal-mediated enhancement of hydrogel anti-swelling and water retention

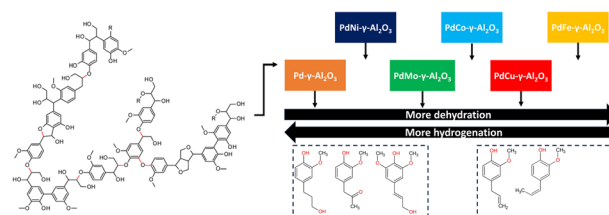
Kudzanai Nyamayaro, Takeo Iwase, Savvas G. Hatzikiriakos and Parisa Mehrkhodavandi\*



1551

## Enhancing the performance of heterogeneous palladium based catalysts in the mild reductive depolymerization of soda lignin through addition of a non-noble metal and tuning of the preparation strategy

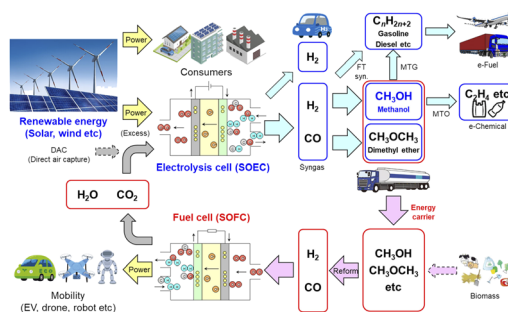
Tibo De Saegher, Boyana Atanasova, Pieter Vermeir, Kevin M. Van Geem, Jeriffa De Clercq, An Verberckmoes and Jeroen Lauwaert\*



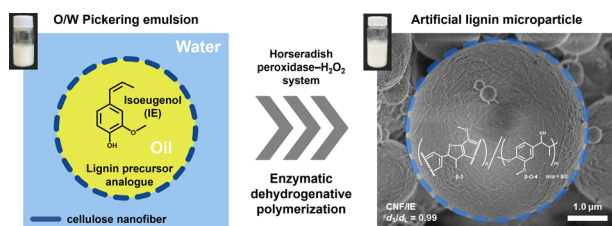
1568

## Co-electrolysis SOEC and internal reforming SOFC for achieving a carbon-neutral society

Hirofumi Sumi\*



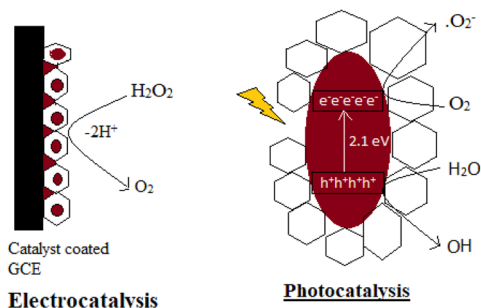
1580



### Synthesis and structural design of microspheres comprising cellulose nanofibers and artificial lignin polymer by enzyme-mediated Pickering emulsion templating

Yuna Tanaka, Qi Li, Mayumi Hatakeyama and Takuya Kitaoka\*

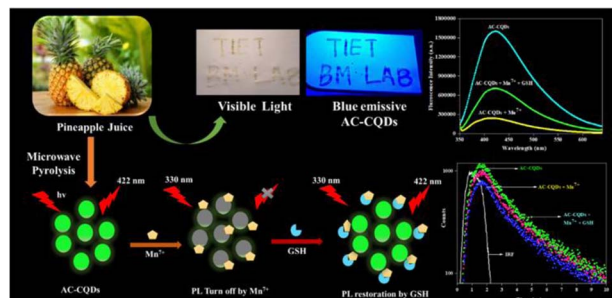
1590



### Synthesis of a high dielectric constant graphene supported iron oxide and its electrocatalytic activity in a H<sub>2</sub>O<sub>2</sub> fuel cell and as an efficient photocatalyst

Madhavi D. Shete\* and J. B. Fernandes

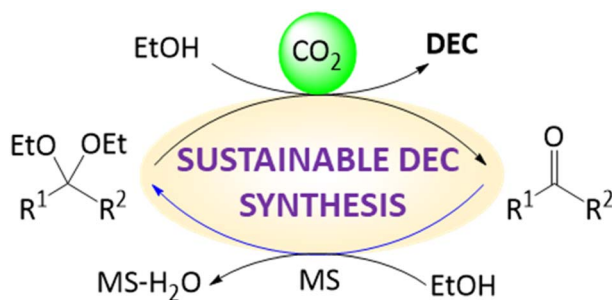
1599



### Sustainable synthesis of carbon dots from *Ananas Comosus* as renewable biomass: nanomolar level detection of glutathione

Mallika Phull, Amjad Ali and Banibrata Maity\*

1613



### Sustainable synthesis of diethyl carbonate from carbon dioxide and ethanol featuring acetals as regenerable dehydrating agents

Wahyu S. Putro, Seiichiro Ijima, Seiji Matsumoto, Satoshi Hamura, Mizuho Yabushita, Keiichi Tomishige, Norihisa Fukaya\* and Jun-Chul Choi\*

