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Editorial: Editors' showcase: Smart materials

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Editorial on the Research Topic
Editors' showcase: Smart materials

1 Introduction

This Research Topic aims to highlight the recent research from editorial board members in the field of smart materials, which focuses on new insights, novel developments, current challenges, latest discoveries, recent advances, and future perspectives. It shines a light on all areas that our editors found interesting. Four outstanding contributions are finally selected and featured in this Research Topic Research Topic with a broad diversity of research on design, characterisation and application of smart materials from leading researchers. The detailed contribution of each paper is highlighted in the following section.

2 Contribution highlights

Anemometer for tracking the velocity and orientation of wind is of great importance for optimising and controlling the trajectory of remotely piloted aircraft (RPA) systems. Traditional anemometers have disadvantages for micro and small RPAs, including high aerodynamic resistance, high energy dissipation and high cost for signal processing. To address these Research Topic, Ramanathan et al. designed a novel anemometer with airfoil-shaped, low resistance and integrated sensors for real-time wind velocity and orientation measurement. In this innovative design, a double-layer capacitive pressure sensor with a polyvinylidene fluoride diaphragm was integrated for gauging wind velocity, which was modeled and evaluated by static pressure chamber tests. In addition, a digital magnetometer was employed to track magnetic field of Earth in 3D for the measurement of airfoil orientation. Both capacitive sensor and digital magnetometer were integrated into NCAC 2412 profile for wind tunnel tests in the laboratory. The results demonstrated that the sensitivity of capacitive sensor could reach 1.84 fF m^2/s^2, and airfoil has unique stable orientation accuracy in the range of -2° to $+ 2^\circ$.

Absorption and isolation of acoustic waves, especially low-frequency waves, is another challenge in engineering. In an original research article, Gao et al. investigated the design of duct muffler working in low frequencies of less than 2000 Hz, which involved two Helmholtz resonators (HRs). Porous materials were filled into a cavity of muffler to form matching/

mismatching impedance. To study HR degeneracy and corresponding absorption capacity of acoustic waves, a numerical method for structural design was developed and then validated experimentally. The results show that the muffler designed in this study is able to not only realise satisfactory acoustic wave absorption, but also keep itself on the subwavelength scale. Besides, the introduction of porous materials minimises the need for accuracy in the selection of geometric parameters, and permits consecutive adjustments in operating frequency. The promising outcomes of this research offer a potential solution to the problem of noise isolation and acoustic absorption for different application scenarios.

In a review article, Haddad et al. summarised the latest application research of vanadium dioxide (VO_2), which is a smart material with the phase transition between semiconductor and metallic state by adjusting temperature. VO_2 has a wide range of applications, including flexible substrates, MEMS resonators, nano-devices, *etc.* Especially, recent experimental research on VO_2 application in smart thermal device was presented by the authors in detail. The tests of emissivity were conducted during thermal power balance-based vacuum transition under the conditions of both high and low temperatures, which were compared to infrared measurement. This research demonstrates that increasing emissivity adjustability and device dimension can contribute to a better application on space surface with reduced cost.

In a research article, to resolve the problem of poor performance of existing electrorheological (ER) polishing materials due to phase separation, Hu et al. fabricated a novel ER polishing material based on cerium-doped titanium dioxide (CDTD). A parametric study on the effects of main parameters, including machine gap, particle concentration, rotation velocity and voltage, on polishing performance were investigated by experimental studies. Compared to traditional ER polishing materials with simple mixtures, the proposed CDTD-based ER polishing material has more excellent ER effect and polishing capability subjected to electrical fields. Furthermore, increasing rotation velocity and voltage and decreasing the machining gap are capable of significantly improving the efficiency of ER polishing and enhancing the quality of workpiece surface. The finding in this research opens up new research directions for further advancement of ER polishing procedures.

3 Summary

Four papers published on this Research Topic offer readers recent research in smart materials with regard to a variety of aspects, including developments of smart transducer and actuator, a state-of-the-art review of smart materials and material characterisation. The Research Topic editors wish that these featured contributions are beneficial to the readers and provide inspiration for future research in the field.

Author contributions

This editorial was jointly drafted and edited by YY, WL, and LZ.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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