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Section Information:

The section is focused on applications of digitalization, Internet of Things (IoT), additive technologies (3D printing), cloud data storage, smart sensors, artificial intelligence (AI), deep learning, machine learning, cybersecurity, blockchain, and nonthermal and advanced thermal processing. Nonthermal technologies include high-power ultrasound, pulsed electric fields, high-voltage electrical discharge, cold plasma, high-pressure processing, UV-LED, pulsed light, and e-beam; advanced thermal food processing techniques include microwave processing, ohmic heating etc. The section will include research presenting the state of the art in the tools of Industry 4.0, including smart manufacturing, simulations, and process integrations that are applied or can be implemented in industry. Current research and applications of digitalization, Internet of Things (IoT), additive technologies (3D printing), cloud data storage, and smart sensors in connection with applications of nonthermal and advanced thermal technologies will be highly welcome, as will research considering the synergies of combination and connective application of nonthermal technologies and advanced thermal technologies. Authors are also encouraged to submit research and review papers on the applications of artificial intelligence (AI), deep learning, machine learning, cybersecurity, and blockchain in nonthermal and advanced thermal processing.

Section Pharmaceutical Processes

Featured Papers

DOI:10.3390/pr10020404

Digitalized Automation Engineering of Industry 4.0 Production Systems and Their Tight Cooperation with Digital Twins

Authors: Petr Novák and Jiří Vyskočil

Abstract: Smart production systems conforming the Industry 4.0 vision are based on subsystems that are integrated in a way that supports high flexibility and re-configurability. Specific components and devices, such as industrial and mobile robots or transport systems, now pose full-blown systems, and the entire Industry 4.0 production system constitutes a system-of-systems. Testing, fine-tuning, and production planning are important tasks in the entire engineering production system life-cycle. All these steps can be significantly supported and improved by digital twins, which are digitalized replicas of physical systems that are synchronized with the real systems at runtime. However, the design and implementation of digital twins for such integrated, yet partly stand-alone, industrial sub-systems can represent challenging and significantly time-consuming engineering tasks. In this article, the problem of the digital twin design for discrete-event production systems is addressed. The article also proposes to utilize a formal description of production resources and related production operations that the resources can perform. An executable version of such formalization can be automatically derived into a form of a digital twin. Such a derived digital twin can be enhanced with operation duration times that are obtained with process mining methods, leading to more realistic simulations for the entire production system. The proposed solution was successfully tested and validated in the Industry 4.0 Testbed, equipped with four robots and a transport system, which is utilized as a use-case in this article.

DOI:10.3390/pr10091881

Evaluation of Relative Permittivity and Loss Factor of 3D Printing Materials for Use in RF Electronic Applications

Authors: Tomas Picha, Stanislava Papezova and Stepan Picha

Abstract: 3D printing is more and more often used for the development and manufacturing of electronic devices and components. These applications require knowledge about the dielectric properties of the used materials—in particular minimal and stable values of relative permittivity and dielectric losses. The paper deals with the testing of the relative permittivity and loss factor of materials as follows: PLA (in three dye modifications), PET-G, and ABS and ASA in the frequency range 1–100 MHz. It was found that relative permittivity varied between 2.88–3.48 and the loss factor was in the range 0.03–4.31%. In terms of relative permittivity, all tested materials manifested a slight decline with increasing frequency. Concerning loss factor PLA (colorless) and ABS were proven to be more suitable for electrotechnical application due to the lower values and frequency dependences of the loss factor. Different results were observed in PLA-Silver and PLA-Metallic green. These materials showed a higher frequency dependency of loss factor with increasing frequency. The reasonable influence of added dyes was found. A study of the internal structure of the tested materials has not proven any significant defects (air gaps) that could affect the material's dielectric properties.

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