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2 mensajes

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Javier Martínez <javiermtnezg@gmail.com> 28 de noviembre de 2016, 8:09
Para: JAVIER MARTINEZ <javier.martinez@iner.gob.ec>

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Material selection for multi-tubular fixed bed reactor Fischer-Tropsch reactor

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Abstract: Multi-tubular, fixed bed, Fischer-Tropsch reactor (MFBR) appears as an essential technology for the energy future; moreover it is required to improve and to reduce operation costs. This research used multi-criteria decision making methods (MCDM) for the material selection of a MFBR. It focused on fulfilling the technological requirements for constructing the vessel and piping of a MFBR, while costs reduction is considered as part of the analysis. The MCMD methods are complex proportional assessments of alternatives which apply methods such as grey relations (COPRAS-G), operational competitiveness rating analysis (OCRA), a new additive ratio assessment (ARAS) and technique for order of preference by similarity to ideal solution (TOPSIS). The criteria weighting was performed by compromised weighting method composed of analytic hierarchy process (AHP) and entropy methods. The ranking results showed that ASME SA-106 and ASME SA-106 29 would be the best materials for the vessel and piping of a MFBR.

Keywords: multi-criteria decision making methods; MCDM; multi-tubular fixed bed reactor Fischer-Tropsch reactor; MFBR; material selection. **Reference** to this paper should be made as follows: Martínez-Gómez, J. and Narváez C., R.A. (xxxx) 'Material selection for multi-tubular fixed bed reactor Fischer-Tropsch reactor', *Int. J. Mathematics in Operational Research*, Vol. 10, No. 1, pp.1–29.

Biographical notes: Javier Martinez Gómez received his Industrial Engineering degree from Carlos III University in Madrid in 2008 and Master's degree in Materials Science and Engineering at Universidad Carlos III de Madrid in 2010. He received his PhD in Materials Engineering Science from Universidad Carlos III de Madrid in 2013. His fields of research are related to clean cooking, multicriteria decision methods and material science. He currently works as a postdoctoral researcher at the National Renewable Energy Institute, INER and as academic staff at Pontificia Universidad Catolica del Ecuador (PUCE).

Ricardo A. Narváez C. has a background in chemical engineering with a focus on renewable energy and energy efficiency, and also control systems and systems dynamics related with such expertise. His experience includes bioenergy conversion technology research. In a more specific manner, technology validation and prototyping of gasification, pyrolysis and anaerobic digestion can be mentioned. Moreover, downstream use of bio-based materials such as syngas conversion into fertilisers and liquid products is another of his research interests.

1 Introduction

The selection of the optimal material for a precise purpose is a crucial function in designing and development of products. Materials selection has become an important source at engineering processes because of economical, technological, environmental parameters (Tawancy et al., 2007; Jee and Kang, 2000). The large number of influencing factors turns the selection process into a critical issue (Chatterjee et al., 2011). Holloway (1998) explained the importance of material selection in engineering applications, and also enlightened the potential environmental impact caused by improper selection. In addition, Jahan et al. (2010) reported that material selection using MCDM techniques are increasing gradually in engineering applications.

Material selection parameters such as product function, product life cycle, manufacturer/stakeholder requirements, usability, product personality, environmental considerations and costs are considered in multiple/complex selection models. However, only several methods can deliver quantitative values for selection. The improper selection of a given material could affect productivity, profitability, cost and image of an organisation due to potential growing demands for extended producer responsibility (Jee and Kang, 2000; Ashby et al., 2004). For this reason, the development of products, success and competitiveness of manufacturers also depends on the selected materials.

Material selection has been the core topic of several research processes that give off assessment methods to compare the behaviour of elements according to their properties (density, yield strength, specific heat, cost, corrosion rate, thermal diffusivity, etc.). These assessments can deliver efficiency indicators in order to select the best alternative for a given engineering application (Ashby et al., 2004). Thus, efforts need to be extended for identifying those criteria that influence material selection for a given engineering application. The purpose of this analysis is to eliminate unsuitable alternatives and select the most appropriate alternative using simple and logical method (Ashby et al., 2004).

Comparing candidate materials, ranking and choosing the best material is one of most important stages in material selection process. Multi-criteria decision making methods (MCDM) appear as an alternative in engineering design due to its adaptability for different applications (Wang and Carlsson, 2016; Heidarzade et al., 2016; Azimi and Solimanpur, 2016). The MCDM methods can be broadly divided into two categories, as;

1 multi-objective decision making (MODM)