

Faculty of Mathematics and Natural Sciences

Profile report: Polymeric products (polymeer producten)

Discipline: Chemical Product Engineering

Level: Tenure Track Assistant professor

Fte: 1.0 fte

1. Scientific discipline

Chemical engineering; chemical product technology

Chemical product technology is a relatively new discipline aimed at the study (and development) of novel or existing chemical products. This often takes place in well-defined industrial environment, which in turn determines the product functions/specifications. As such, chemical product technology aims at providing reliable and well-defined structure-process-property relationships, thus linking the chemical structure and composition of a given product with its properties as well as the process used to factually make the product. This general scientific challenge includes also the correlation between the chemical structure of a polymeric surfactant (e.g. structure and intake of the different monomers as well as number and length of the blocks) with the relevant properties for application (e.g. rheology and surface activity). Such comprehensive studies, factually bridging the gap between the nano-, meso- and macroscopic scales, are lacking in the open literature and constitute thus relevant scientific novelties.

2. Vacancy

This position is opened by the board of the faculty (letter with reference EMK/gl/16/00086) and will be embedded in the research group Chemical Product Engineering, which is embedded in the Engineering and Technology institute Groningen (ENTEKG).

3. Selection committee (BAC)

Prof. Dr. Ir. J.M.A. Scherpen (director ENTEKG, chair)

Prof. Dr. F.Picchioni (ENTEKG)

Prof. Dr. P.Rudolf (director GSS, ZIAM)

Prof. Dr. H.J. Heeres (ENTEKG)

Prof. Dr. G.J.W. Euverink (ENTEKG)

Prof. Dr. S. De Wildemaan (University of Maastricht)

Student of IEM/CE

HR advisor: Mr. H. Haagsma (HR)

4. Research area

The current trend of the chemical conversion industry towards specialty products (i.e. relatively low volumes and high price) relies often on the use of polymeric materials able, due to their chemical structure, to perform several different functions in many applications. A paradigmatic example is constituted by polymeric surfactants able to display in solution a thickening effect as well as interfacial properties. These polymeric amphiphilic structures constitute a relevant investigation subject at academic level and find applications in coatings, enhanced oil recovery as well as food and cosmetic industry. The current position has been created to strengthen the research efforts in the chemical engineering research of the Engineering and Technology institute

Groningen (ENTEG) of the Faculty of Mathematics and Natural Sciences (FMNS). Major focus will be on the development of novel, amphiphilic polymeric materials. Attention will be paid to the relationship between the end product requirements (depending on the specific application), its chemical and macromolecular structure and the corresponding synthetic procedures. In this context, the study of the macromolecular structure (e.g. number and average length of the block) in relation to the rheological and surface properties is of crucial importance as it represents an often-lacking factor in the open literature. The ideal combination with the bio-based nature of the product (whenever possible) nicely fits into the current “circular economy”-driven research efforts.

5. Research group and institute

ENTEG is a young research institute at the University of Groningen factually embedding engineering research in the general fields of chemical, mechanical and industrial engineering. Research themes within the institute span a large field of engineering disciplines in several industrial contexts. ENTEG has a proven focus and strength in chemical product technology through the Chemical Product Technology research group. This group specifically aims at the study (and development) of novel chemical products in a well defined industrial context stemming from recent and new developments at academic level.

6. Local and (inter)national position

The concept of “Product Technology” entails an integrated design of a chemical product and the corresponding process. Few research groups at European level use such an integrated approach to product design as they are mostly linked to specific aspects of the design (for example either material properties or synthesis). On the other hand, such a comprehensive approach becomes even more crucial when making allowances for current interest towards specialty polymeric products, particularly of amphiphilic nature. On a national level, such comprehensive approach is factually lacking. However, when conceptually intersecting these concepts with the biobased character, positive interactions are envisaged with the research group of Prof. S. de Wildemaan (University of Maastricht). At the same level, integration of activities with the other research projects/groups within ENTEG (e.g. group of Prof. H.J. Heeres in terms of the biobased character of the polymeric material) is of pivotal importance. The novelty of this integrated approach as well its broader applicability to several different industrial products ensures the necessary scientific relevance as well as concrete possibilities for valorization of the envisaged results.

7. Expected contributions to research The candidate is expected to develop internationally recognizable own research lines focused on the establishment of structure-property relationships for amphiphilic polymeric structures. Application in solutions as well as in the solid state should constitute the ideal goal. The candidate should cooperate with relevant groups, in particular within the ENTEG research programs. In particular collaboration with the Chemical Reactor Technology group (prof. dr. H.J.Heeres) and with those related to biotechnology-oriented disciplines within ENTEG (prof. van der Maarel en prof. Euverink) is expected at the level of joint research (master and PhD) projects.

8. Expected contributions to teaching

The candidate will be involved in the teaching activities and curriculum development of Chemical Engineering and Industrial Engineering and Management (Ba, Ma and PhD levels) within the FMNS, examples being Polymer Chemistry (BSc IEM) and Interfacial Engineering (Ma CE and IEM). This requires excellent educational skills and a thorough understanding of the fundamentals of polymer chemistry and engineering as well as interfacial engineering. Last but not least, the candidate is expected to supervise BSc and MSc thesis projects of the above two mentioned studies.

9. Expected contributions to management

The candidate is expected to contribute significantly to the organizational and management tasks of the research group (Chemical Product Engineering) as well as of the research institute (ENTEg).