Faculty of Mathematics and Natural Sciences

Profile report: Rheology (rheologie)

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 rheological behaviors of several different polymeric materials as function of the macromolecular structure (e.g. the presence of branches on branches) and the final product composition (e.g. dilute vs. semi-dilute regime).

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 a group in the Engineering and Technology institute Groningen (ENTEG).

3. Selection committee (BAC)
Prof. Dr. Ir. J.M.A. Scherpen (director ENTEG, chair)  
Prof. Dr. F. Picchioni (ENTEG)  
Prof. Dr. P. Rudolf (director GSS, ZIAM)  
Prof. Dr. H.J. Heeres (ENTEG)  
Prof. Dr. G.J.W. Euverink (ENTEG)  
Prof. Dr. A. Gotsis (Technical University of Crete)  
Student of IEM/CE  
HR advisor: Dhr. H. Haagsma

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. Water-soluble polymers currently finding applications in coatings, enhanced oil recovery as well as food and cosmetic industry constitute a paradigmatic example. Besides the chemical structure, the rheological behavior of these polymers in solution is of paramount importance as it factually constitutes the link to the desired application. The same holds true for systems in which the melt rheology is an important factor. 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 rheological characterization of polymer solutions and melts. Attention will be paid to the relationship between the end product requirements (depending on the specific application)
and its rheological behavior in the end product or during processing. In this context the (to be studied) relationship between macromolecular structure (e.g. presence of branches-on-branches) and the rheological behavior of the final product (often in semi-dilute or concentrated regime) is of crucial importance.

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 and their rheological behavior. On a national level, such comprehensive approach is factually lacking. At the international level, positive interaction is expected with the research group of prof. dr. A. Gotsis (Technical University of Crete). Integration of activities with the other research projects/groups within ENTEG (e.g. group of Prof. H.J.Heeres) 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. The current position will focus on engineering studies towards the rheological characterization of polymeric systems. The aim is to provide active support for the research efforts (and possibly help in defining new research projects) in the general area of rheological characterization, specifically oriented towards polymeric products of industrial relevance.

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 a variety of polymeric systems. 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 ITM (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 Products (Ma CE and IEM) and Transport Phenomena (Ba CE and IEM). 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).