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# Newsletter

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**elcome** to the 1<sup>st</sup> issue of the IPROCOM newsletters! IPRO-COM is a research and training consortium funded by European Commission (EC) through the Marie Curie Initial Training Network scheme of the seventh framework programme. IPROCOM consists of 14 partners (10 full partners and 4 associate partners) from 8 European countries, and is training 15 researchers (i.e. IPROCOM fellows). Each fellow works on a specific research projects.

IPROCOM uses a systematic approach to understand the manufacturing processes for producing particulate products (e.g., pharmaceutical tablets, fertilizer pellets, detergent tablets and catalysts pellets) and to develop predictive computer models for these processes. In doing so, an integrated computer modelling platform can be established to guide the product development and process design, which can also be used to optimize the manufacturing processes.

IPROCOM was officially started in January 2013. I am so glad that we have successfully recruited 15 fellows who started their research projects. In addition, our 1st advanced training course (i.e. ATC1) on "Process Understanding of particulate Product Manufacturing" was a great success, as it provided not only well structured training to IPRO-COM fellows but also excellent opportunities for our fellows to start working as a team. I am extremely grateful to RCPE for organizing ATC1, we all had an enjoyable and fruitful time in Graz!

--- Prof. Charley Wu, IPROCOM coordinator

### **Inside this issue**

- A glimpse of our research reported by Ana P Gago
- A brief report of the 1st IPROCOM advanced training course
- Dissemination activities
- Outreach activities
- Research exchange





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IPROCOM Supervisors at the kick-off meeting in UoS



**IPROCOM** fellows at the ATC1 in RCPE

# Research

## HARDNESS OF TABLETS AND RIBBONS

### by Ana Perez Gago

Tablets are nowadays the most common dosage form for delivering medicines, but sometimes their production is not as easy as it looks like, therefore, many efforts have been made in improving the pharmaceutical manufacturing process. In most of the cases, it is necessary to process the formulation through a process named granulation, which basically transforms powders into granules. In the pharmaceutical industry there are two types of granulation: wet and dry granulation, depending on if a liquid is involved or not.

Roll compaction is a dry granulation process which compacts the raw powder using two counter-rotating rolls and subsequently the compacts (also called ribbons) are broken to granules, which will subsequently be used for making tablets. Although roll compaction is a process having several advantages, there is the problem that the ribbons present a non-uniform density distribution. (Fig. 1).



Figure 1: A photograph of compressed ribbons

Hence, the aim of this study was to explore if there is a correlations between mechanical properties of tablets and ribbons.

### **1. EXPERIMENTS**

Several batches of flat tablets of Microcrystalline Cellulose were produced by direct compression of the powder, and then, their dimensions and mass was measured to calculate the density.

Different lots of ribbon made also of MCC were also produced, and for calculating their density, ribbons with both sides flat were selected and cut in rectangle pieces as regular as possible. The dimensions of these rectangles were measured together with the mass, for calculating the density.

In addition, hardness of these powder compacts were also measured using a micro-indentor consisting of a small indenter that penetrates on the surface of the tablet or ribbon until a predetermined force is achieved and the indent size is measured to determine the microhardness.

#### 2. RESULTS

The microhardness or Universal Hardness (HU) was plotted against the porosity values obtained for tablets and ribbons in Fig.2

As it was expected and for both tablets and ribbons, when the porosity decreases, there are fewer pores and therefore the tablet or ribbon is stronger, so the HU is higher, what means that more force is needed to deform the sample.

From the comparison between tablets and ribbons, it can be noticed that at low porosities graphs for both samples almost overlap, although some values tend to be higher for the ribbons. In general, the values for the ribbons tend to be more scattered than for the tablets.



Figure 2: Correlation between HU and porosities of tablets and ribbons

# Training

# The First IPROCOM Advance Training Course





The first IPROCOM advanced training course (ATC 1) on "Process Understanding of Particulate Product Manufacturing: Fundamentals & Characterisation" was successfully held in Research Center Pharmaceutical Engineering (RCPE), Graz, Austria, on 20th-24th January 2014. All IPROCOM fellows and some external participants attended the ATC1.

The ATC1 consisted of lectures and handson sessions, which were delivered by IPROCOM supervisors and experts at RCPE. From this training course, IPROCOM fellows learnt fundamental knowledge of particulate product manufacturing in pharmaceutical, catalysts and powder metallurgy industries, how to characterize particulate materials and various modelling techniques that can be used to analyse particulate product manufacturing.



"In addition to perform scientific research, IPROCOM also aims to train a cohort of young scientists with the necessary depth and breadth of experience combined with the task-specific research skills and generic and transferable skills that are required to communicate and work effectively across disciplinary and sectoral boundaries in the field of particulate product manufacturing."

— Prof. Charley Wu

# Dissemination

# The 9th World Meeting on Pharmaceutics, Biopharmaceutics and Pharmaceutical Technology

IPROCOM fellows, Mohammad Hassan Khalid (ESR 12), Kitti Csordas (ESR2) and Ana P Gago (ESR3) attended the 9th world meeting of Pharmaceutics, Biopharmaceutics, and Pharmaceutical technology in Lisbon, Portugal, on 31st March - 3rd April 2014. At this conference, Hassan presented his work on "Generalised in-vitro invivo corelation model based on Genetic Programming". Fellows had scientific discussions with participants from the industry and academia and also attended plenary lectures and oral presentations on different topics.



Kitti Csordas, Ana Pérez Gago, and Mohammad Hassan Khalid at the poster session

## IPROCOM fellows spoke at the 7th World Congress on Particle Technology (WCPT7)

IPROCOM fellows, Miss Serena Schiano and Mr. Simone Loreti, attended WCPT7 in Beijing, China on 19th -22nd May 2014. They presented their work on "The impact of roll compaction on mechanical properties of pharmaceutical powders" and "DEM modeling of fragmentation of pharmaceutical ribbons during impact", respectively.

Miss Serena Schiano commented: "This is my first international conference experience that is useful to improve my transferable skills, such as oral presentation, personal introduction, communication and interaction with experts working in companies, universities and research institutes. Also attending presentations followed by questions and discussions with the speakers was very useful for acquiring a deeper knowledge of different fields and new techniques." "The conference has been an important experience of my professional training, a great opportunity to embark on research world, focusing on the emerging trends in the research on particle technology, and to improve our communication skills. It is also worth noting that interactions with other researchers were very useful to receive feedback and comments on my research, and to obtain new ideas from other oral presentations and plenary talks." Said Mr. Simone Loreti.

Other IPROCOM members, including Prof. Charley Wu and Dr. Marvin Pei (UoS, UK), Drs Michele Marigo (JM, UK) and Olivier Lecoq (EM, France), also attended WCPT7.





# Outreach

## MAIN À LA PÂTE-2014 - 'Open Laboratory Day'

#### By Lucia Perez Gandarillas

On 20th March 2014, the activity "La Main à la Pâte" took place in Ecole des Mines d'Albi. "La Main à la Pâte", which means "The hands-on", was initiated by Georges Charpak, Nobel Prize of Physics. The main objective is to open the laboratories to children in order to promote science. This great scientist (Georges Charpak) noticed that "a mind trained in scientific reasoning is less permeable to prejudice". Learning science from an early age can form "free beings, able to find a truth which is not levelled at them".<sup>(1)</sup> Since 1995, an increasing success has been observed in France, demonstrating that this initiative has been well accepted by public.



Eleven schools from the French department of Tarn were invited and "La Main à la Pâte" was carried out thanks to the collaboration of the staff and students from Ecole des Mines. During the event, the researchers presented their research activities, showing experiments and demonstrations. Nearly 270 children and their teachers had the opportunity to be close to different fields such as energy, environment, powders, and processing.

IPROCOM fellow, Miss Lucia Perez Gandarillas (ESR4), collaborated actively in this event. A hands-on workshop called 'Powder's behaviour' was organized by the powders-research group. As a brief introduction, the three states of matter were explained. After that, experiments such as crystallization and absorption were demonstrated.

Lucia not only accompanied the children in the visit to the laboratories, but also, as an experimental demonstrator, she showed them what happens when we introduce everyday objects (balloon, marshmallow and shaving cream) in a bell jar.



Why does a balloon expand when placed in a bell jar?



Why does the shaving cream increase in its volume when placed in a bell jar?

The children showed huge enthusiasm by discovering science and she was amazed by the curiosity of children. It was a very rewarding day. She realized how important the concept of "open laboratory for school kids" is. La Main à la Pâte provides numerous bridges between elementary schools and schools of engineering and it fits perfectly into the concept initiated by Georges Charpak.

<sup>(1)</sup> Enfants, Chercheurs et Citoyens, G. Charpak, 1998 "Children, researchers and people, G. Charpak, 1998.

# Visits

## **IPROCOM Industry-Academia Collaboration**

by Andreja Mirtic

The group led by Prof. Chuan-Yu Wu from University of Surrey visited the Pharmaceutical Development department and laboratories that support the development of the drug formulation and manufacturing processes for new medicines in AstraZeneca. The visit was a great opportunity for IPROCOM fellows from University of Surrey, Serena Schiano and Simone Loreti to see all the equipment needed for industrial scale manufacturing processes and to see where the in silico tools can be applied in manufacturing.

The aim of this visit was also to meet with the IPORCOM members working in AstraZeneca, Gavin Reynolds and Andreja Mirtic. Andreja is working on development of population balance models for simulating ribbon milling and how different material and process properties affect the granule size distribution. Her work is in close collaboration with the work of Simone who is studying the same process in more microscopic view using DEM modeling. Both modeling techniques requires experimental data for model validation and here the work of Serena is placed. Serena works on pharmaceutical powder characterization and uses many analytical techniques in order to obtain the bulk power properties.

During this meeting IPROCOM members discussed about their collaborations and planned their secondments. Secondments are a great opportunity for the fellows to get some cross-sector experiences as well as to discover new places and meet new people. It is the IPROCOM vision to encourage interactions between industry and academia and to connect researchers form multinational environment and it is a good opportunity for fellows to create a tight network of friendships as well as future partnerships.



The IPROCOM network is comprised of 10 partners that include partners from academia research institutes as well as industry and the great emphasis is placed on gaining experiences in cross-sector environment. Each fellow is encouraged to take secondment in the institution that represents the different sectors from the institution where his position is placed. The IPROCOM industry-academia collaboration improves the fellows' career prospects, broad interdisciplinary and complementary skills that are necessary skills to work both in industry and academia. It is important that the fellows can experience how companies are challenged in the competitive environment and are striving for market success. being trained in new methodologies and technologies, transferring their innovating ideas into development of predicting in silico tools which could bring many advantages in the manufacturing of the drugs.





Planned research exchanges within IPROCOM

### Fellow of this issue



## M. Zawbaa, was born in Cairo, Egypt. He received his B.Sc. and M.Sc. degrees from Information Technology Department, Cairo University,

Egypt. Currently, he is a Assistant Lecturer at Information Technology Department, Faculty of Computers and Information, BeniSuef University, Egypt.

He has authored/co-authored over 24 scientific publications in peer-reviewed journals and international conference proceedings. He has served as the technical program committee member of various international conferences and reviewer for various international journals. Also, he is one of the founding members of the Scientific Research Group in Egypt (SRGE), which brings together active Egyptian researchers and those with a professional interest in a particular aspects and related disciplines. His research interests are in the areas of computer vision, pattern recognition, video and image processing, machine learning, data mining, and biometrics.

He is now one of the early stage researchers (ESR) and based in Babes-Bolyai University, Romania. The goal of his project is to apply machine learning techniques for in-silico simulation and modeling of roll compaction.

The IPROCOM project provides the opportunity for him to attend various training courses and open days, network with other universities and industrial partners, which will be beneficial for him. His plan for 2014 is to attend two international conferences (International Conference on Intelligent Systems IS'14, Warsaw, Poland, and International Conference on Advanced Machine Learning Technologies and Applications (AMLTA 2014), Egypt) to promote IPROCOM and his project.



## **Key Dates**

<mark>8 - 11 July 2014</mark> 21 October 2014 21 - 23 October 2014

IPROCOM ATC2, Albi, France Mid-term Review meeting, Krakow, Poland IPROCOM ATC3, Krakow, Poland

#### For more information please contact

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