

# Clextrusion

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In brief



**CLEXTRAL CHILE**

**JOSÉ COELHO**  
**CLEXTRAL**  
**SOUTH AMERICA**

### **SERVICES : a worldwide network...**

By the time you read this Clextrusion number 8, the Clextral Services network will have added yet another international location, with the opening of an office in **Chile**. After Firminy, Tampa, and Singapore, it is now time for Santiago to host a Clextral service location staffed by a specialist in twin-screw extrusion.

**José Coelho** has logged 9 years of solid experience as a Project Engineer with Clextral Inc in Tampa. José has travelled extensively in Latin America as he supervised the start-up of Clextral's industrial installations in various countries. His new responsibilities include management of the Clextral's service activities in South America.

Competence, proximity, responsiveness and communication, in fact, José speaks French, English, Spanish and Portuguese, will ensure the satisfaction of our many customers in this vibrant market.

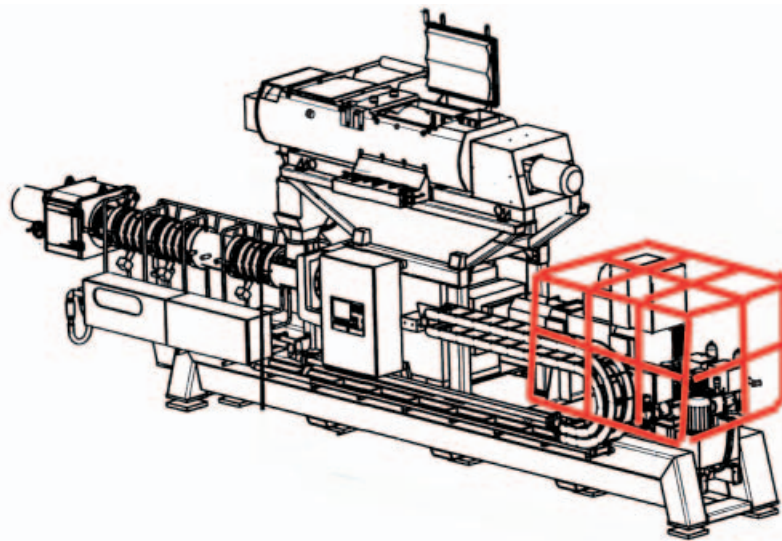
Georges Hallary  
Manager, Clextral Services.

[www.clextrusion.com](http://www.clextrusion.com)

**CLEXTRAL**

# D evelopment & Process

Performances



In the development of our equipment, occasionally issues must be addressed that are outside our usual concerns of optimizing performance and productivity of Clextral extruders. In these cases, our engineers rely on the expertise of our outside partners for solutions.

This was the case when Clextral engineers examined extruder production noise in order to optimise the sound levels of the Evolum range. We collaborated with the CETIM (Centre d'Etudes Techniques des Industries de la Mécanique) right from the design stage. This study, which began in 1994, is still continuing today.

In this context, we have reflected upon the concepts of noise, on the measurement of the noise, and on its standards and regulations.

## WHAT IS NOISE ?

To define noise, we must first understand sound. Sound is vibration which is described by characteristics of intensity (or volume), tone (from base to treble), frequency (expressed in Hertz) and duration.

Its propagation occurs at variable speeds, depending

on the medium - 340 m/s in air, 1500 m/s in water, and 5000 m/s in steel, until it is received.

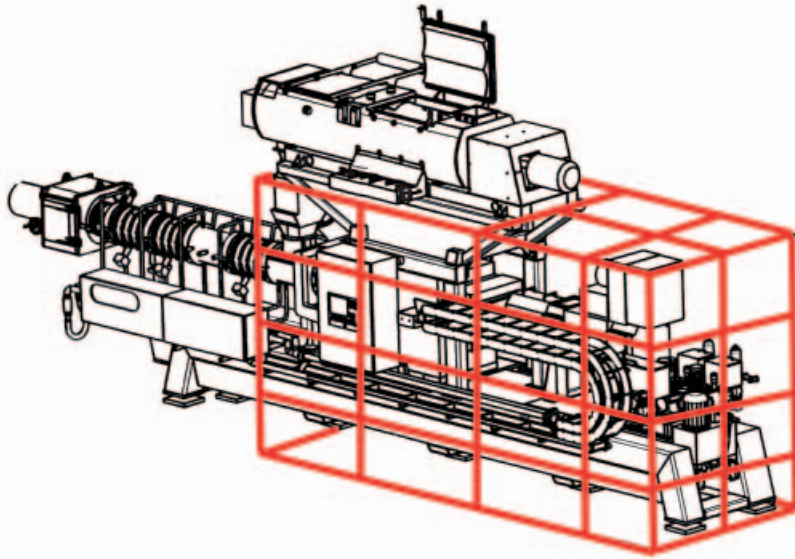
Noise is a complex mixture of sounds of differing intensities and frequencies. It is also an acoustic phenomenon, generally considered to be unpleasant and annoying.

It is easy to see that the sound sensation is dependent on the physical characteristics of sounds and of noise. A sound which is too weak cannot be heard. A sound which is too strong can cause annoyance and even pain. There are limits to the intensity of the physical stimulus, outside of which listening is impossible.

## The ear is a frequency filter

We thus speak of infra-sound or ultrasound to designate vibrations at frequencies which are respectively either too low or too high to be heard by the human ear. Whereas the elephant is capable perceiving infra-sound down to 20 Hz, dolphins and dogs can hear ultrasound between 20,000 Hz and 150,000 Hz. Only frequencies between 20 Hz and 20,000 Hz are audible to humans.

## not to be silenced !



### The ear is a pressure sensor

Between the hearing threshold and the hearing limit, the range of audible sound pressure variation covers the very wide spectrum of 1,000,000 Pascal, which is expressed for convenience in A-weighted decibels.

The level of audible sound pressure variation thus encompasses a range from 0 dB to 120 dB. The following are some points on this scale :

- the threshold of audibility is at 0 dB
- a conversation is around 50 dB
- the threshold of risk is at 85 dB
- the threshold of danger is at 90 dB
- the threshold of pain is at 120 dB

### HOW CAN NOISE BE MEASURED ?

While the ear is a general sensor that perceives a mean level of noise, there are specific methods of gauging sound and resultant noise levels in an industrial setting. Sound intensity measurement allows the industrial engineer to circumvent ambient noise in the local environment and measure specific elements that may contribute to the overall noise levels. This method is preferred to the sound-level meter which measures both the noise source and the environment.

### The method

Sound-intensity measurement is the industrial solution for measuring noise. It takes account of the vibration speed.

I (acoustic intensity in W/m<sup>2</sup>) is equal to V (vibration speed in m/s) multiplied by P (acoustic pressure in Pa).

$$I = P \times V$$

At a given point, we therefore get a vector, that is the noise level and its orientation or direction.

Integration of the incoming and outgoing vectors on a surface S gives the acoustic power level, which represents the noise level of the machine only (measured in dBA).

This very precise method also allows us to isolate the acoustic power of the individual elements of the machine under study. It is thus possible to determine the sound contribution of each element, such as the acoustic power level of the motor, for example..

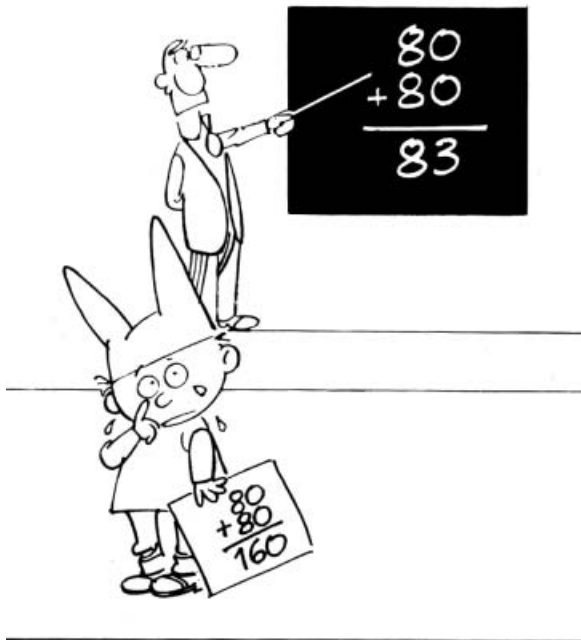
### The results

The results of a sound-intensity measurement study are very accurate. The calculation allows us to obtain the power level of the element studied, which gives the sound level of the machine only.



# D evelopment & Process

## Continuation...



It is possible to develop this same calculation in order to deduce a pressure level in a free field, which gives the sound pressure of the machine only, at a distance X from the measurement surface.

### The standards and the regulations

The European social directive required that 85 dBA should not be exceeded in the industrial plant. When new equipment is designed, the concept of noise is now a crucial consideration. Clextral engineers seized the opportunity to design the Evolum extruders to operate at minimum noise levels by pinpointing sound-generating functions and reducing noise at the source. Compared to the alternative choice of a hood to insulate machine sound levels, this was a sensible and economical solution.

### The EVOLUM and noise

In co-operation with CETIM, the noise levels of the Clextral BC extruder range were measured and analyzed. The objective was to study sound levels in the existing machines, and the relative strength of the each source, in order to determine the elements to be accorded priority treatment.

The **results** showed that the speed of the screws had little influence on the noise level, and that the barrel had negligible radiation.

The sound-intensity measurements proved that the noise sources were mainly associated with the power of the motor, the gearbox, and the chassis which created a drum effect. The acoustic output from the motors and the gearboxes were reduced, which in turn minimized the noise reflected from the chassis.

The chassis was re-engineered to reduce its size thereby minimizing the sound radiation perimeter. Inside, finely plated boxed tubes have replaced heavier welded versions which added to the radiation factor. Extruders were redesigned to enhance stability and rigidity while reducing machine mass to minimize noise reflection.

These technical solutions were validated on prototypes of Evolum extruders to determine if they effectively reduced the sound levels during operation.

Significant noise reductions of 6 to 8 dBA were achieved, depending on the configuration, (for information, a reduction of 3 dBA corresponds to reducing the acoustic pressure by half.) proving that the creative designs employed by Clextral engineers were extremely efficient in managing operating machine noise.



# Service & Maintenance

## ”Chunks” in Moscow.

**The installation of a model BC 92 twin screw extruder for Soya Product, a Russian company located in Moscow, gives us the opportunity to present an additional example of an application which might be unfamiliar : TVP or Textured Vegetable Protein.**

### **A simple process for a healthy product..**

Extrusion cooking is currently the most widespread process for the preparation of the textured vegetable protein. Soya is utilised for its very useful technical and functional properties.

The principle of this process is simple :

Slightly hydrated proteinaceous materials, such as oil-free flours containing between 40 and 50% protein, or concentrate containing 70% protein, are mixed together with other ingredients that may include starch, colouring and flavouring, added nutritional elements and water.

This pre-mix is introduced into the extruder. It is subjected to the combined effects of pressure, temperature and intense mechanical shear. Then, it is converted into a viscous paste.

This plastified mass is extruded through the die of the machine, returning it suddenly to atmospheric pressure. Part of the superheated water contained in the product evaporates, causing an expansion phenomenon which gives the final product an attractive cellular structure.

Finally, a rotating knife cuts the rod of material, which undergoes a drying process in order to reduce the water content further. This creates a shelf stable product with excellent microbiological properties as well as an exceptionally long life span. Upon re-hydration, these ”chunks” of TVP become chewable, and present ”mouth-feel” almost identical to that of meat.

This product has been adopted for vegetarian cooking recipes as a healthy substitute for minced meat, with no cholesterol.

### **The positive results of teamwork**

This particular process of TVP extrusion cooking was developed on the BC 92 extruder, which our team of technicians brought into service for Soya Product. It should be noted that this is the largest extruder model that Clextal has installed for this type of application so far.

The young CEO of Soya Product, Igor STRAVULOV, leads the company in marketing products of a dietary character, such as soya milk, soya-milk yoghurt, ready for use sauces, and so on. Until now, he has been importing TVP for distribution in Russia. He was attracted by the economic benefits of the extrusion cooking process, which has a relatively low cost per tonne of product.

He is very familiar with the nutritional properties of TVP, and of its economic qualities. In Russia, the price per kilo of TVP is 50% lower than that of meat. One of the main benefits of TVP products is their ability to absorb and retain water. In fact, when 1 kg of TVP is re-hydrated with the same amount of liquid as is found in meat, the final product weighs 3 kg. There is therefore a ratio of 1 to 3 in terms of mass, through the absorption of water.

The TVP chunks also stand up well to boiling and to high temperatures. They can be used in instant or freeze-dried soups, ragouts, and special pâtés.

The Soya Product installation produces 2 products, soya chunks, and soya mince, used as ingredients in the manufacture of cooked meat dishes.

The plant started production during 2001, with an active partnership between Clextal and Soya Product production teams which achieved the desired production rates and the quality of the product to be manufactured.

This unit is now producing 1400 kg/hour of TVP, around the clock and seven days per week.

# R Realizations



Cotton,

The contract with the **Uzbek Kogozhi company (Uzbek Paper)** which came into force on 1 August 1999, came to an end in January 2002.



*Grand opening of Yanguiyul line on 20/03/2001*

Between these two dates, one of Clextal's greatest achievements was brought to a successful conclusion.

The Uzbek Kogozhi paper pulp production line, with a capacity of 20,000 tonnes/year was designed, manufactured, installed and commissioned. The installation includes a linters purification unit (cotton by-products in the form of short fibres) - a continuous plant for cooking of the fibres, using a caustic soda process, followed by washing of the fibres in a way that is particularly economic in terms of water, and finally bleaching of the pulp utilizing a hydrogen peroxide process, which respects the environment.

The quality of the pulp, obtained from a TCF process

(with no chlorine agent) and using the twin-screw technology developed by Clextal, results in the production of quality paper.

**Many different stages were required in order to bring this project to fruition :**

All of the planning and construction work was completed in 11 months.

- The process planning determine the line equipment to be used, on the basis of the quantity of pulp to be produced.

- The engineering study divided the equipment between two buildings separated by 150 meters, one holding the dry cleaning equipment, and the other with the pulp production plant. This was followed by a study on the utilities - compressed air, water, electricity and design of the conduits.

- The electricity and automation engineering designed the production control system.

- The many hours of work involved were then consigned into the associated documentation, and a team of Uzbek employees travelled to France to receive training in the Bivis paper-making process.

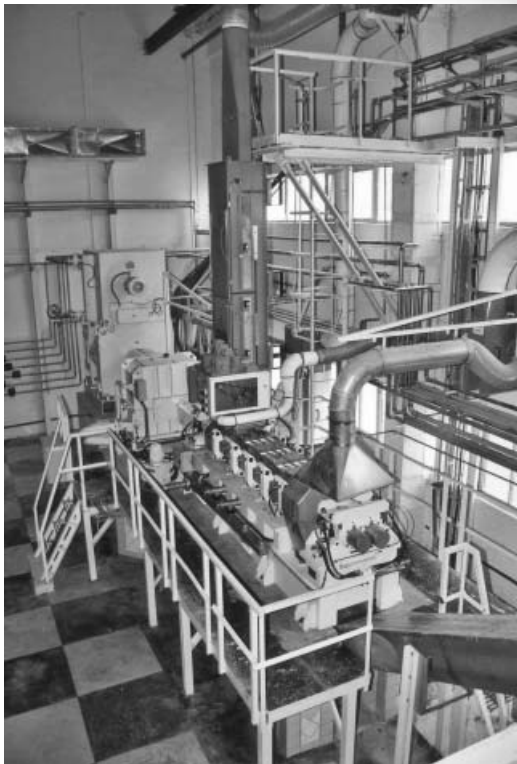
At the same time, we started the twin-screw machines manufacturing, and we acquired additional equipment from our supply partner companies.

At the end of the design and planning phase, and in accordance with contractual conditions, the first batch of 48 crates in 14 containers were shipped by rail in July 2000, followed in August 2000 by 59 crates in 15 containers, for a total of 272 tonnes of equipment.

ideas, people...



Cotton storage room



Bivis 1 : Pre-cutting of the fibres and soda impregnation



Bivis 2 : fibres cutting, washing and bleaching

# R Realizations



*Uzbek Kogozi-Yanguiyul*

By October 2000, once the equipment had been accepted, the staff of the paper plant and their subcontractors began the assembly of the line, and started the installation and the connection of the fluid equipment- all under the supervision of Clextal.

The participation of the customer in these wide-ranging assembly operations turned out to be excellent training as the Uzbek employees became familiar with the equipment.

The first production tests took place in March 2001. These were used to validate this first assembly stage. The process team arrived and teamed up with the paper plant process engineers to start the setting up procedure and production plant adjustment.

The process parameters were then configured for their suitability for the raw material to be used, since the quality of the delivered cotton was not totally consistent. Settings were calculated to enable the production of a very high quality pulp.

All that remained was to optimise the performance of the production line before conducting the official acceptance tests of the line by Uzbek Kogozi.

To this day, Clextal continues to provide its assistance in order to help the customer adapt to the wide variations in the quality of the cotton available in Uzbekistan and delivered to the site.



## Continuation...

The Uzbek Kogozi company, the leading paper plant in Uzbekistan, now has a production plant which turns cotton linters into bleached paper pulp.

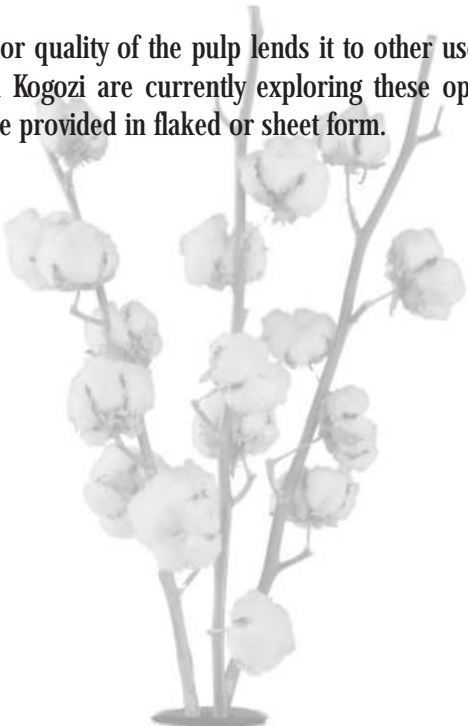
This industrial installation, with a capacity of 20,000 tonnes/year, is located on a new production site at Yanguiyul, close to the capital, Tashkent.

This pulp production enables the country to make use of a raw material which is widely available in Uzbekistan (cotton being one of the great assets of the country) to produce printing and writing papers which satisfy the requirements of the country.

This production unit generates a very small quantity of effluent, which can be treated easily by aerobic means.

The paper is manufactured on a conventional paper-making machine installed on the same site, and delivered on reels to local and foreign users.

The superior quality of the pulp lends it to other uses as well, and Uzbek Kogozi are currently exploring these options. The pulp can be provided in flaked or sheet form.



*interview*

**DIDIER TH VENET**  
*Project Director*

**Clextrusion :** *In a few words, what can you remember of the experience acquired while executing this contract in Uzbekistan?*

**DT :** *If I had to remember only one thing, it would be "adaptation." In fact, this project demonstrated the ability of Clextral to adapt to the requirements of its customer, and to its environment, and showed our ability to do so, even with projects of this immense size. I can give you some examples:*

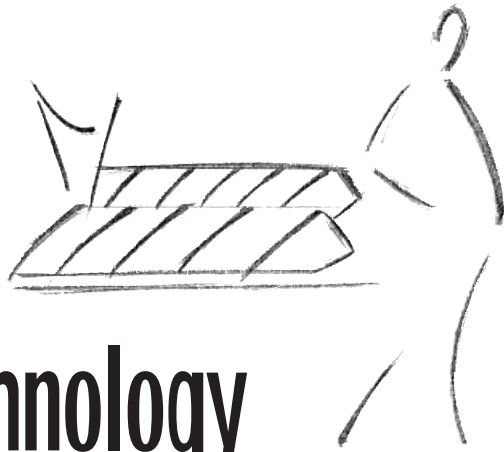
*- Adaptation of Clextral to the technical requirements. It had been planned beforehand to install this production unit in the Tashkent paper plant, but, in fact, it was placed at a different site entirely - at Yanguiyul some 50 km from Tashkent. At the same time, the line had to be modified in order to pass from production of 20,000 tonnes/year of pulp prepared on the paper machines of the site, to two separate production projects - 10,000 tonnes for the paper machines on the site and 10,000 tonnes of different material to be exported, thus enabling foreign currency to be earned for the country.*

*- Adaptation of the twin-screw process. This resulted in the production of paper of an excellent quality, using a raw material which was variable from one delivery to the next.*

*- Adaptation of Clextral to the rules, the standards, and the working methods in a very different business culture.*

*Finally, I can also remember the very high motivation of the Clextral staff, to create an "off-the-shelf" unit in conditions which were sometimes challenging.*

# T echnology



## The Euro

**12 countries with a single currency:** History has been made. Since 1 January 2002, 12 countries, which together form the second largest economic power in the world, parted with their national currencies in order to adopt a single common currency.

One can visualise the gigantic magnitude of this operation by considering that the weight alone of the euro coins introduced totalled than 239,000 tonnes (24 Eiffel Towers), and that if all of the banknotes were laid end to end, they would cover a distance of 1,9 million kilometres, which is 5 times the distance from the Earth to the Moon.

12 countries have adopted the euro. These are Belgium, Germany, Spain, France, Ireland, Italy, Luxembourg, the Netherlands, Austria, Portugal, Finland and Greece.

Denmark, Sweden and the United Kingdom decided to remain outside the euro zone for the present.

The name "euro" was adopted for the currency

by the European Union at the Madrid summit of 1995. It is a name which can be pronounced easily in all of the languages concerned.

The euro notes and coins were brought into circulation in all of the countries in the euro zone on January 1st, 2002.

The euro is divided into 100 cents.

In all, there are 8 coins and 7 notes (5, 10, 20, 50, 100, 200 and 500 euros).

These are now legal tender throughout the euro zone.

The euro notes incorporate an extensive range of advanced security devices. They are at least as well protected against counterfeiting as the national banknotes were previously.



# made in France

## BANQUE DE FRANCE

### A paper mill in the euro zone

The paper mill of the Banque of France (General Department for banknote production), located in the Auvergne at Vic-le-Comte, actually began to produce paper pulp for the French francs banknotes using the CLEXTRAL Bivis process in 1990.

The production of the pulp for the euro banknotes, since July 1999, has not modified the functioning of this line.

The opening of this new production venture concluded a long period of design and testing, carried out together with the Central European Bank and the other national central banks in the euro zone, expressly to produce the specification schedule for each of the denominations and the different fiduciary security signs. This stage took the form of significant, so-called "technical



*The paper for the euro banknotes is dyed in the mass, each denomination with its own colour.*



*In 2002 the printworks will produce just over a billion euro banknotes*

convergence" operations, to ensure that the european paper mills associated with the project would be capable of producing papers which were strictly identical.

After a record year of production in 2001, linked to preparation for the launch of the euro, production in the paper mill has been devoted this year to 5 and 20 euro denominations as well as papers produced for export. The euros are printed by another company located in Clermont-Ferrand.

This site also accommodates a large research and development department, one purpose of which is to design the future generations of fiduciary paper.





## In brief...

**Dr. Sylvie BRUNEL**, Engineer, joined Clextral in February 2002, with the title of **Twin-Screw Extrusion Lines development Manager**.

Dr. Brunel is a graduate of the Ecole d'Application des Hauts Polymères (EAHP) in Strasbourg (France). She completed her Ph.D. between 1995 and 1998 at the Solvay research centre in Brussels, in reactive extrusion applied to polymer materials. From 1999 to 2001, she held the post of Extrusion Process Engineer with the Dynaplast company in France.

You will be able to meet the **CLEXTRAL** staff and those of its partners, **Afrem International** and **Lymac**, at numerous exhibitions during 2002. These include :

### **NATIONAL PASTA ASSOCIATION**

14-16 April 2002 - Naples, FL - UNITED STATES OF AMERICA

### **INTERPACK**

**THE EVOLUM HT 32** will be showing on our Stand 2 A 14

24-30 April 2002 - Düsseldorf - GERMANY

### **IRAN AGRO FOOD**

19-22 May 2002 - Teheran - IRAN

### **PACKTECH-FOODTECH**

22-24 May 2002 - Shanghai - CHINA

### **ALGER INTERNATIONAL FAIR**

13-22 June 2002 - Alger - ALGERIA

### **IFT FOOD EXPO**

16-19 June 2002 - Anaheim - California - UNITED STATES OF AMERICA

### **AACC Annual Meeting**

13-17 October 2002 - Montréal - CANADA

### **IPA**

18-22 November 2002 - Paris Villepinte - FRANCE

### **FIE**

November 2002 - GERMANY

**The e-mail addresses of Clextral Inc** have changed, and are now constructed on the following base : **@clextralusa.com**. For example : Mike Rhinehart address is [mrhinehart@clextralusa.com](mailto:mrhinehart@clextralusa.com).

The contact address becomes : **[clextralusa@clextralusa.com](mailto:clextralusa@clextralusa.com)**

**The results of research work carried out by Clextral R&D team are available in the form of publications :**

### **EXTRUSION COOKING : Technologies & Applications**

Ed R.GUY, Woodhead Publishing Limited, Cambridge, U.K.2001 (ISBN : 185573 559 8).

2 chapters were written by **clextral** engineers :

- Jérôme MOTTAZ and Laurent BRUYAS : **Optimised thermal performance in extrusion**, chapter 4, 51-82

- Jean Marie BOUVIER : **Breakfast cereals**, chapter 7, 133-160.

### **INTERNATIONAL POLYMER PROCESSING, volume XVI - n°4 - 351, 362, 2001.**

-B.VERGNES, G.SOUVETON, ML.DELACOUR, A.AINSER : **Experimental and Theoretical Study of Polymer Melting in a Co-rotating Twin-Screw Extruder.**

Following the example of the installation of the Clextral test plant in Firminy, **Clextral Inc. is equipping its test plant with a pilot Evolum HT 53 machine**, scheduled for start up in May 2002, and will operate on a very busy test schedule in the foreseeable future.

CLEXTRAL S.A. B.P 10  
42702 Firminy cedex  
FRANCE

Tel. 33 4 77 40 31 31

Fax. 33 4 77 40 31 23

E.mail : [clxsales@clextral.com](mailto:clxsales@clextral.com)

CLEXTRAL Inc

14450 Carlson Circle

Tampa, FL 33626 USA

Tél. 1 813 8544434

Fax. 1 813 8552269

E.mail : [clextralusa@clextralusa.com](mailto:clextralusa@clextralusa.com)

CLEXTRAL A.P.

4<sup>th</sup> floor, 74 C Duxton road

SINGAPOUR 089533

Tel. 65 6 225 27 26

Fax. 65 6 225 29 39

E.mail : [eallibe@clextral.com](mailto:eallibe@clextral.com)

CLEXTRAL is opening a representative Office in South America.

José Coelho, who was previously based with our American subsidiary, is assuming responsibility for this new establishment :

CLEXTRAL SOUTH AMERICA.  
C/O CFCCI

Marchant Pereira 201, OF.701

CASILLA 5-D

SANTIAGO

CHILE

Tel. 56 2 225 55 47

Fax. 56 2 225 55 45

E.mail : [jcoelho@clextralusa.com](mailto:jcoelho@clextralusa.com)