

# SNF Organic Binder
# Polyacrylamide binders

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SNF
WATER SCIENCE

SNF Group – September 2023

SNF Group – 2023 Company Overview

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# About SNF

2022

We are a specialty chemical company, world leader in polyacrylamide production

**€5B**
**2022 Revenue**
(2021 : €3.6B)

**7,500**
**2022 Total Employees**
(2021 : 6,900 employees)

**450K**
**End-Users**

**56%**
**2022 Market Share**

Privately held company
Founded in 1978

We are an expert in water chemistry and our products are used in all applications using water

## Flocculation
SOLID/LIQUID SEPARATION

## Drag Reduction
REDUCED ENERGY CONSUMPTION FOR PUMPING

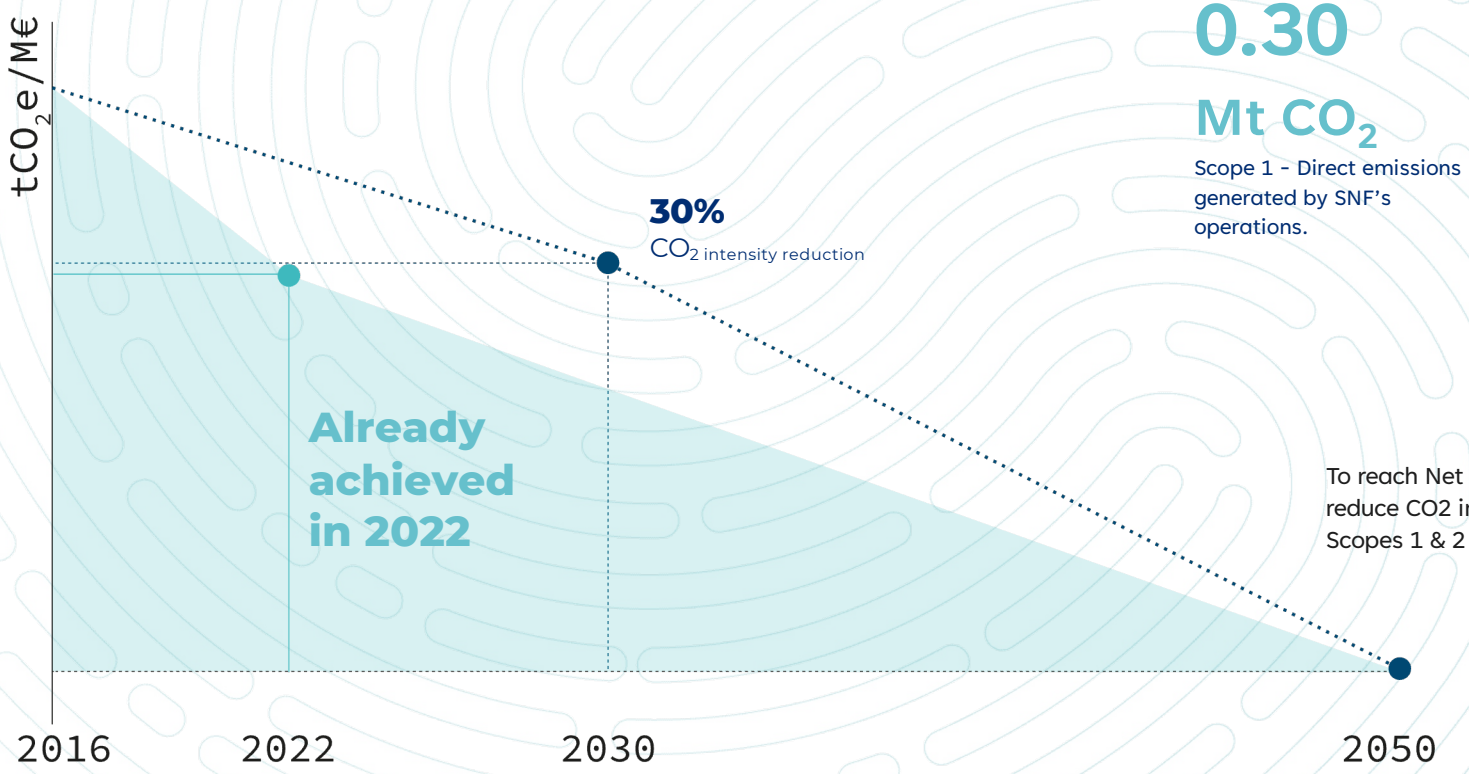
## Viscosity Modification
**ORGANIC BINDERS**

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# Carbon-neutral by 2050

## 2030 objectives already achieved in 2022




**0.30**

**Mt $CO_2$**

Scope 1 - Direct emissions generated by SNF's operations.

**0.33**

**Mt $CO_2$**

Scope 2 - Indirect emissions associated with the purchase of electricity, and generation of steam, heat, or cooling water by SNF.

To reach Net Zero by 2050, our goal is to reduce CO2 intensity by 30% by 2030 on Scopes 1 & 2 (compared to 2016).

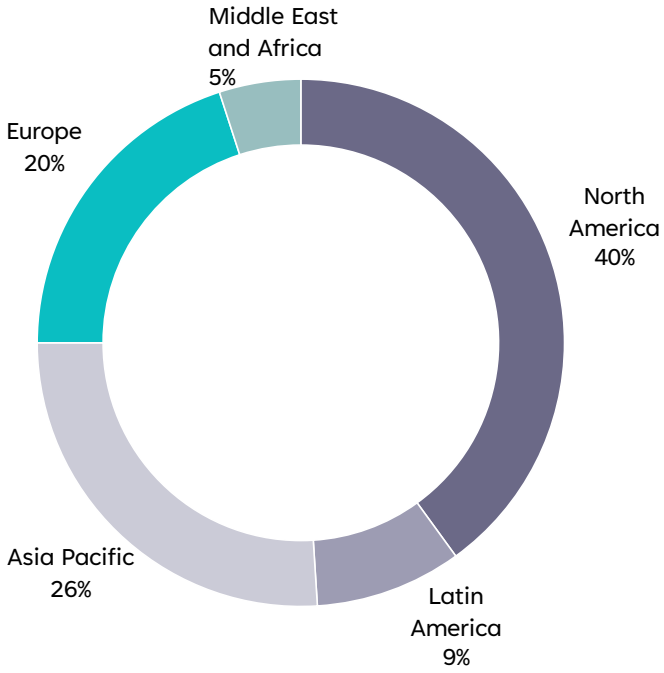
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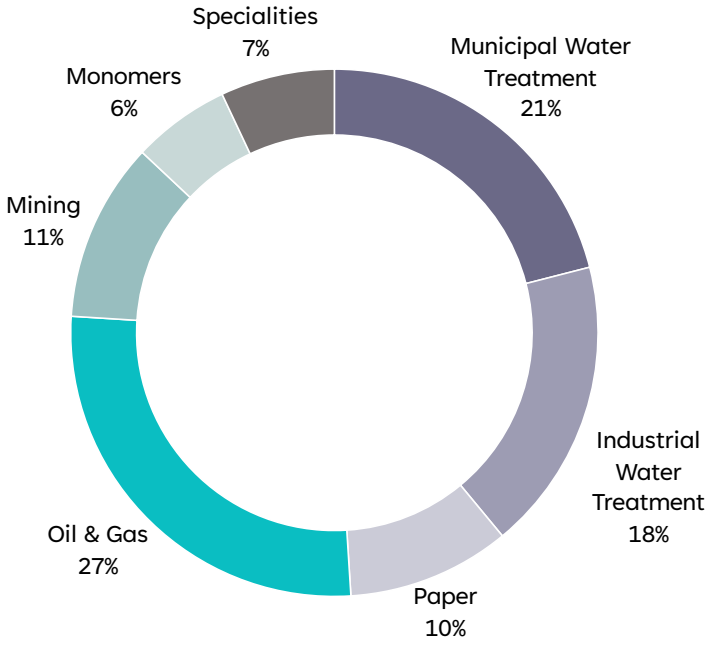
# Diversified Business Model

## ACROSS GEOGRAPHIES AND INDUSTRIES

### SALES BY GEOGRAPHIES

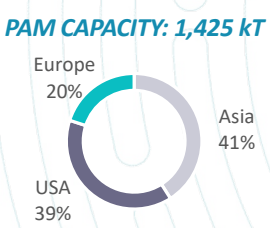


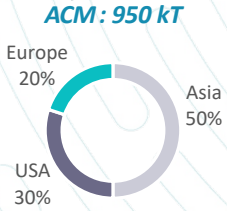

### SALES BY MARKETS

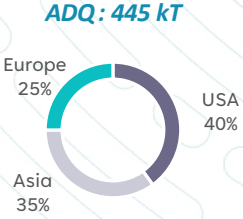



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# Global Manufacturing Footprint




Andrézieux, France

Riceboro, GA

Plaquemine, LA

Taixing, China

Ulsan, South Korea

Rudong, China

Gandhidham, India

Vizag, India

SNF Group Headquarters

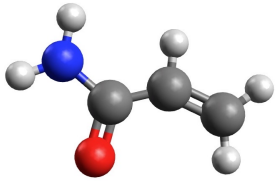
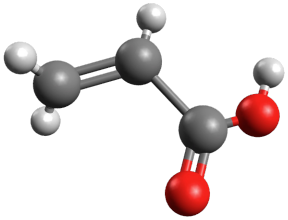
Major Sites

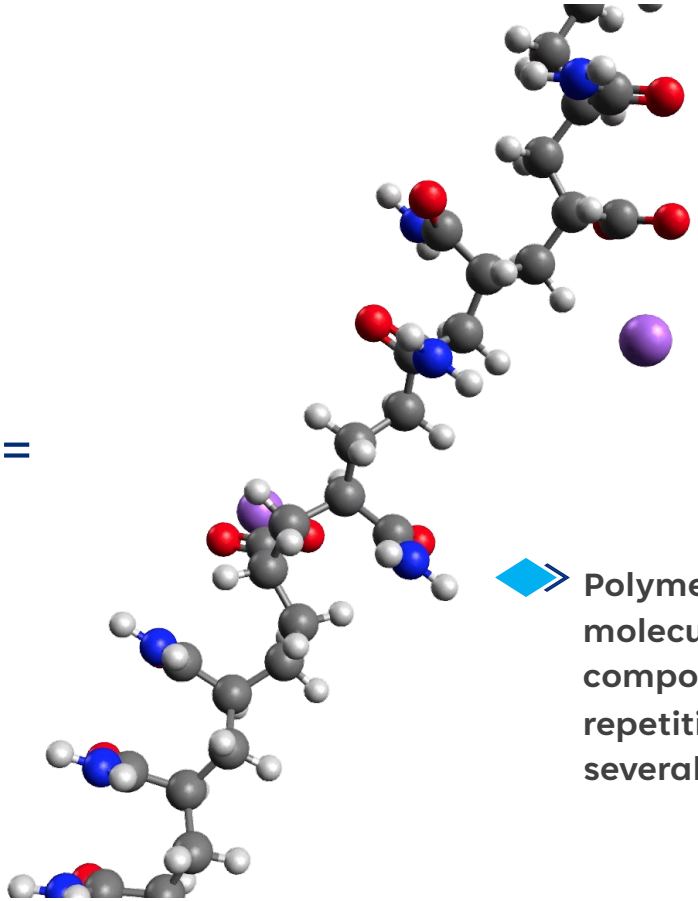
Satellite Sites

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# Monomers and Polymers

n  + m  =

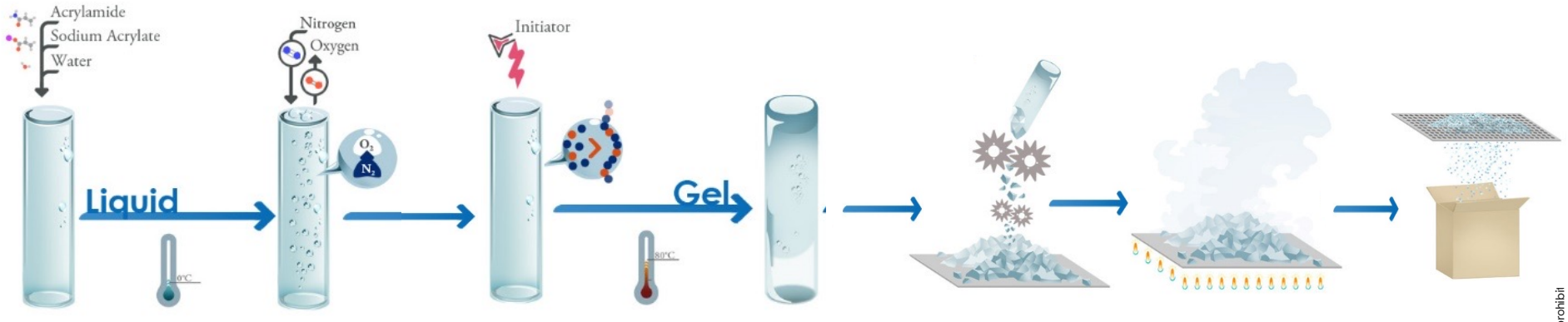


- Monomer #1
- Monomer #2
- Polymers are large molecules composed of repetitions of several monomers

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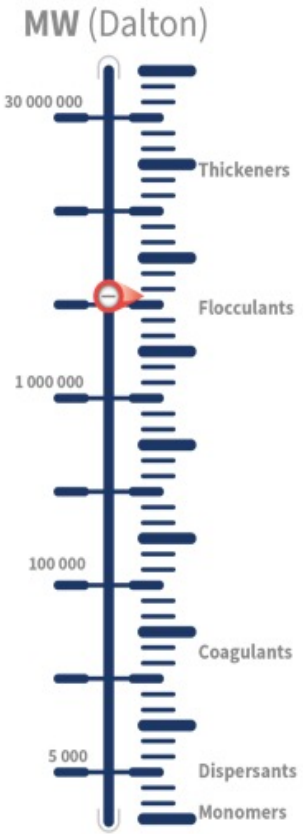
# Powder Polymerization Process

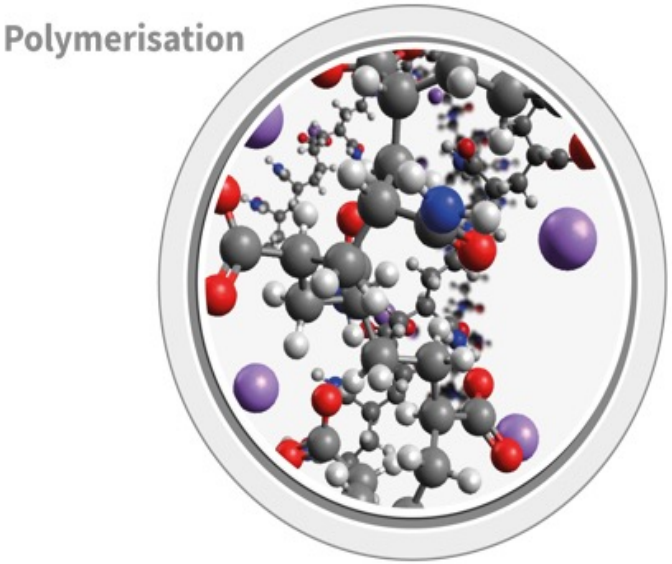


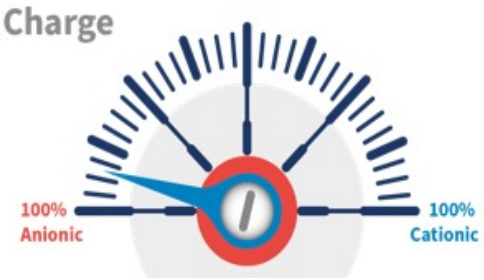

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# The definition of SNF Polyacrylamides

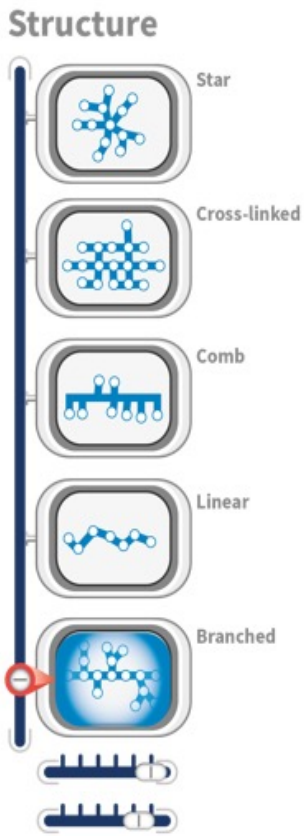






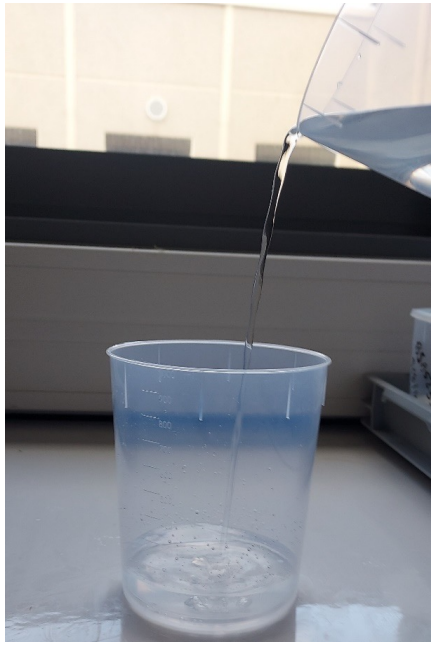



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# Viscosity Modification

- Without Polyacrylamide, linear flowing



- With Polyacrylamide, the physical state of water changes

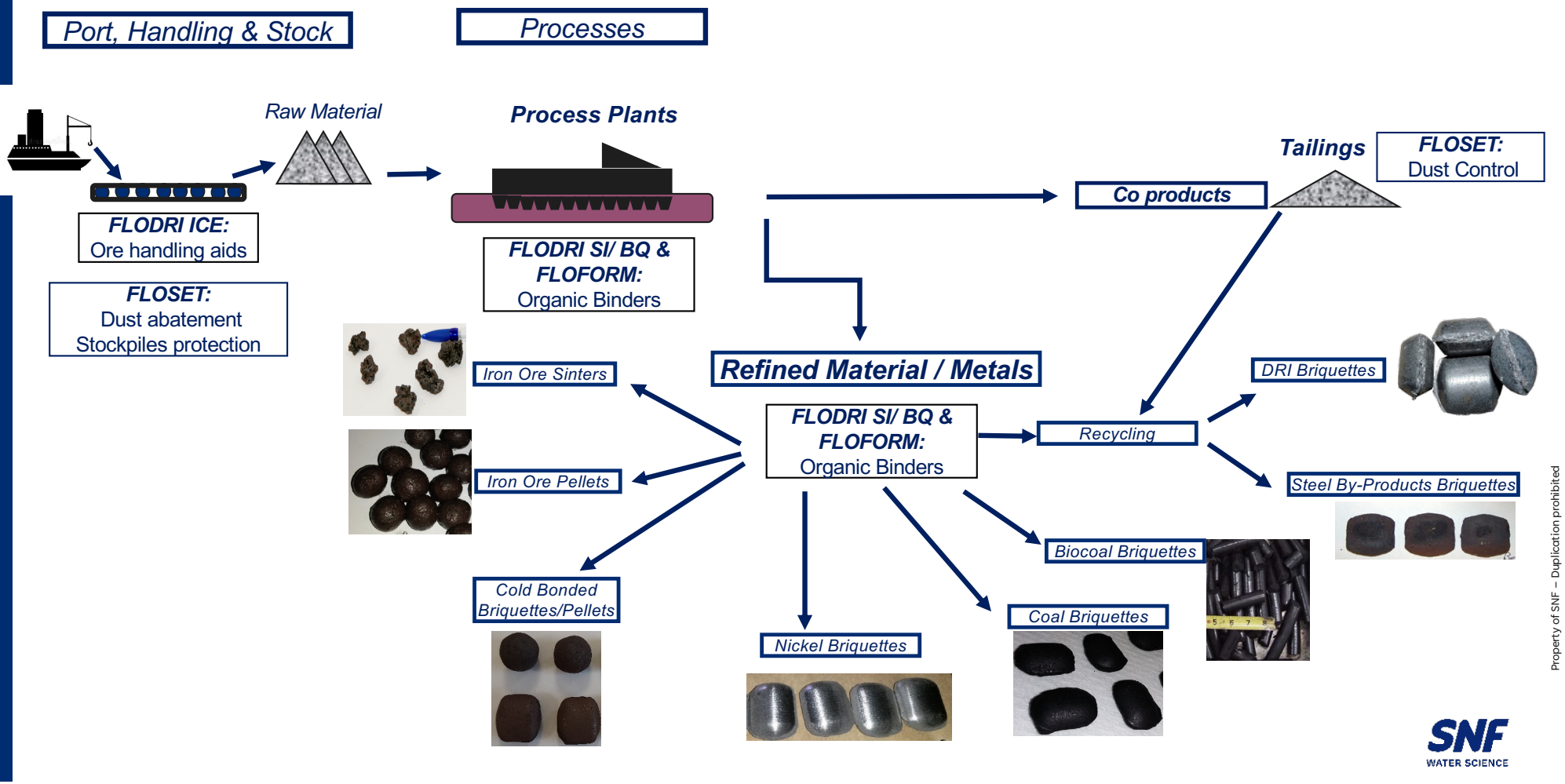


- **This is what happens to the moisture during the agglomeration steps.**
  **The water become stickier, more viscous so become more efficient to cover and bind the particles.**

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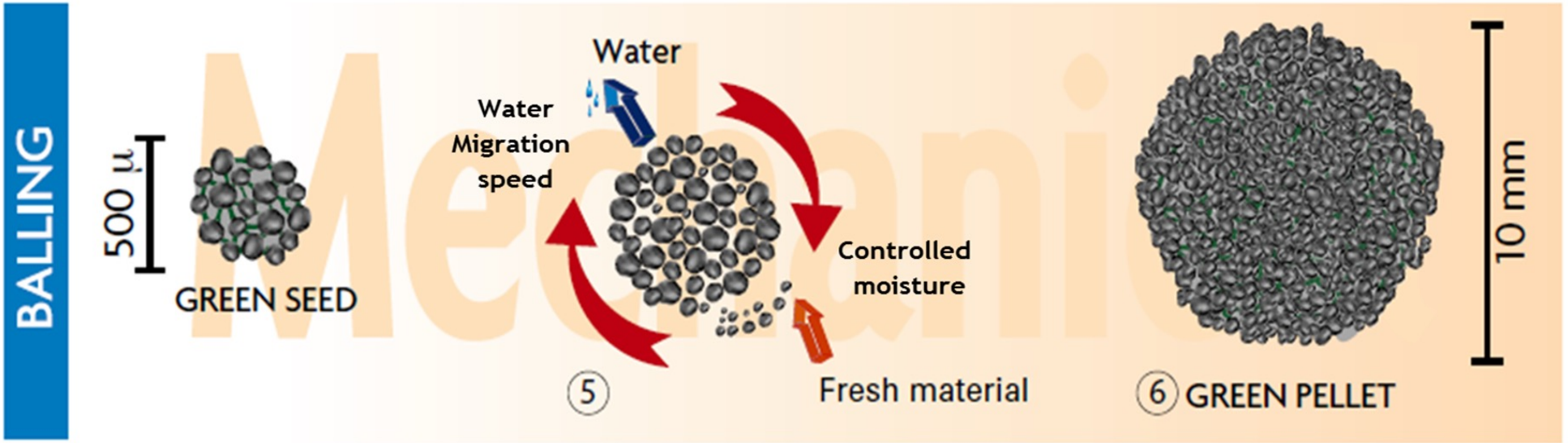
# INDUSTRIAL PROCESSES – WHERE SNF BINDERS ARE USED




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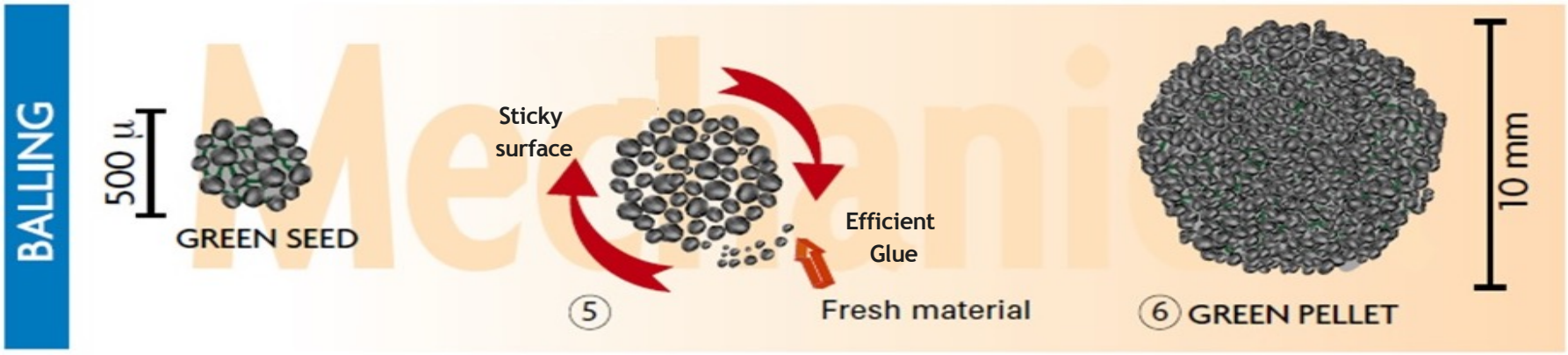
# Key point 1: Controlled migration speed of water




SNF's binders will accelerate or slow the migration speed of the water, leading to a speed control.

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# Key point 2: Viscous and sticky pellets surface




- Our wide portfolio of polymer allows the fine tuning of the final binder formula with respect of the customer's requirements and developments

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# Induration process: FLOFORM behavior

INDURATING




**Conclusion:** SNF can propose binder formulas to allow the balling to work with all type of iron ore and at lower level of moisture: the LOI will be less leading to cost savings

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# Benefit with Organic Binder (FLOFORM)

**Raise of metal content**

- Dosage with polymers is very low (less than 1% Active)
- FLOFORM doesn't introduce any inorganic contaminants ($SiO_2$, $AL_2O_3$, Cl...)

**Polymers allow to work at lower moisture levels**

- The pellets surface is wet enough to have a uniform growth.
- Drops, GCS and DCS are kept at a good levels.

**Polymers produce rigid and plastic agglomerates**

- The green agglomerates don't break during the transport on conveyors.
- Better bed permeability thus better productivity in the furnaces.

**Direct reduction (DR) grade agglomerates (pellets and briquettes)**

**Dedicated formulas**

- Better compatibility with ores / materials.

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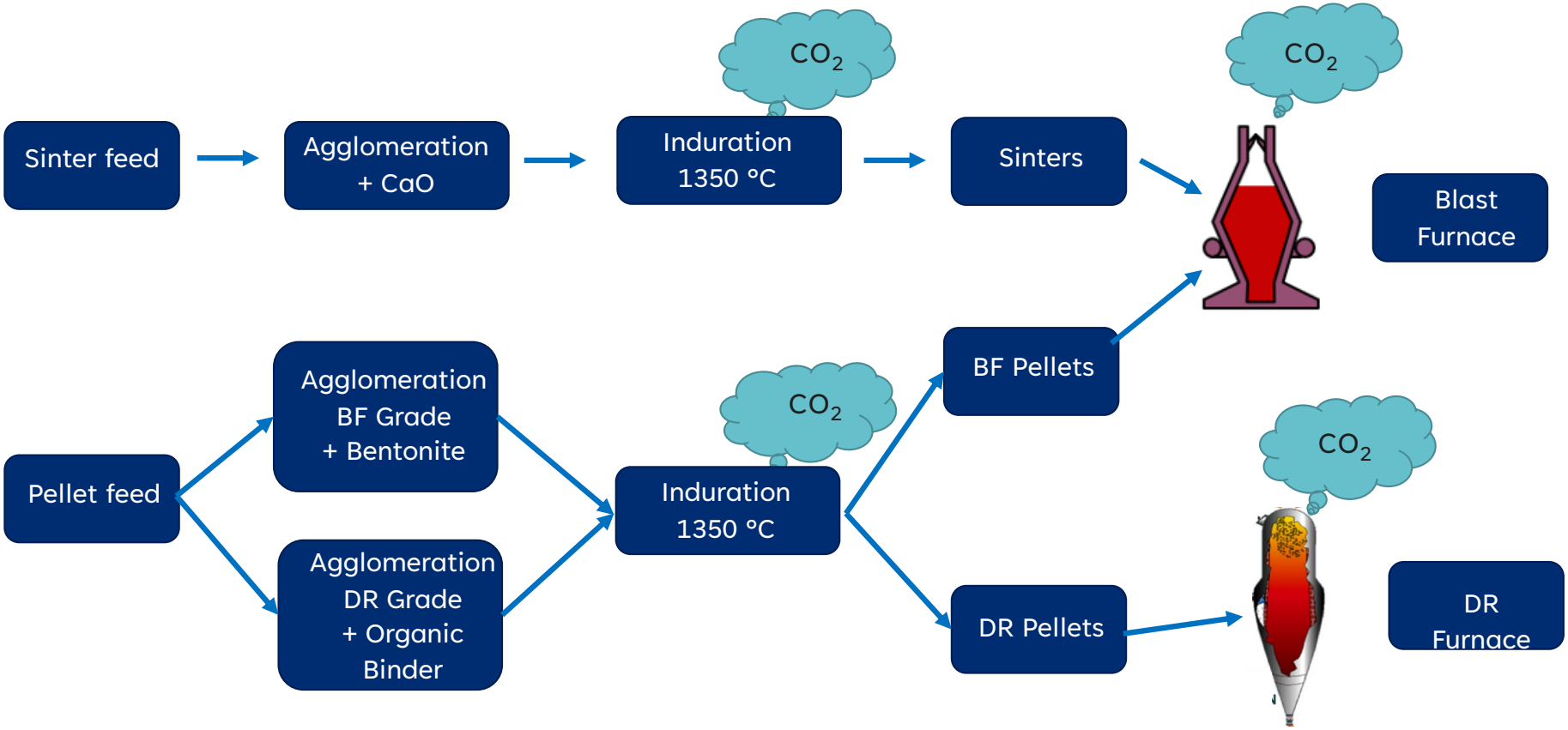
# FLOFORM IN THE FUTURE

- FLOFORM is now used in several Pellets Plants (Brazil, Mexico, Canada, India, China)and is tested in several other countries.
- SNF is selling more than 8 000 MT/y of FLOFORM, and the demand is still increasing.
- The new formulas developed by SNF during the last years allow the pellets plants to:
  - Increase the Drops and plasticity of the pellets
  - Reduce the Green pellets Moistures, which leads to a better firing
  - enhance the DCS and CCS of the pellets.
- The demand of DR pellets is growing and will continue to grow: less bentonite, more Organic Binders
- To help the mines when the silica content is too high, pellets plants switch to polymers to keep the DR pellets in the specifications
- SNF is working on Cold Bonded Pellets projects to find a viable solution to skip the firing processes (both Sinter and Pelletization)

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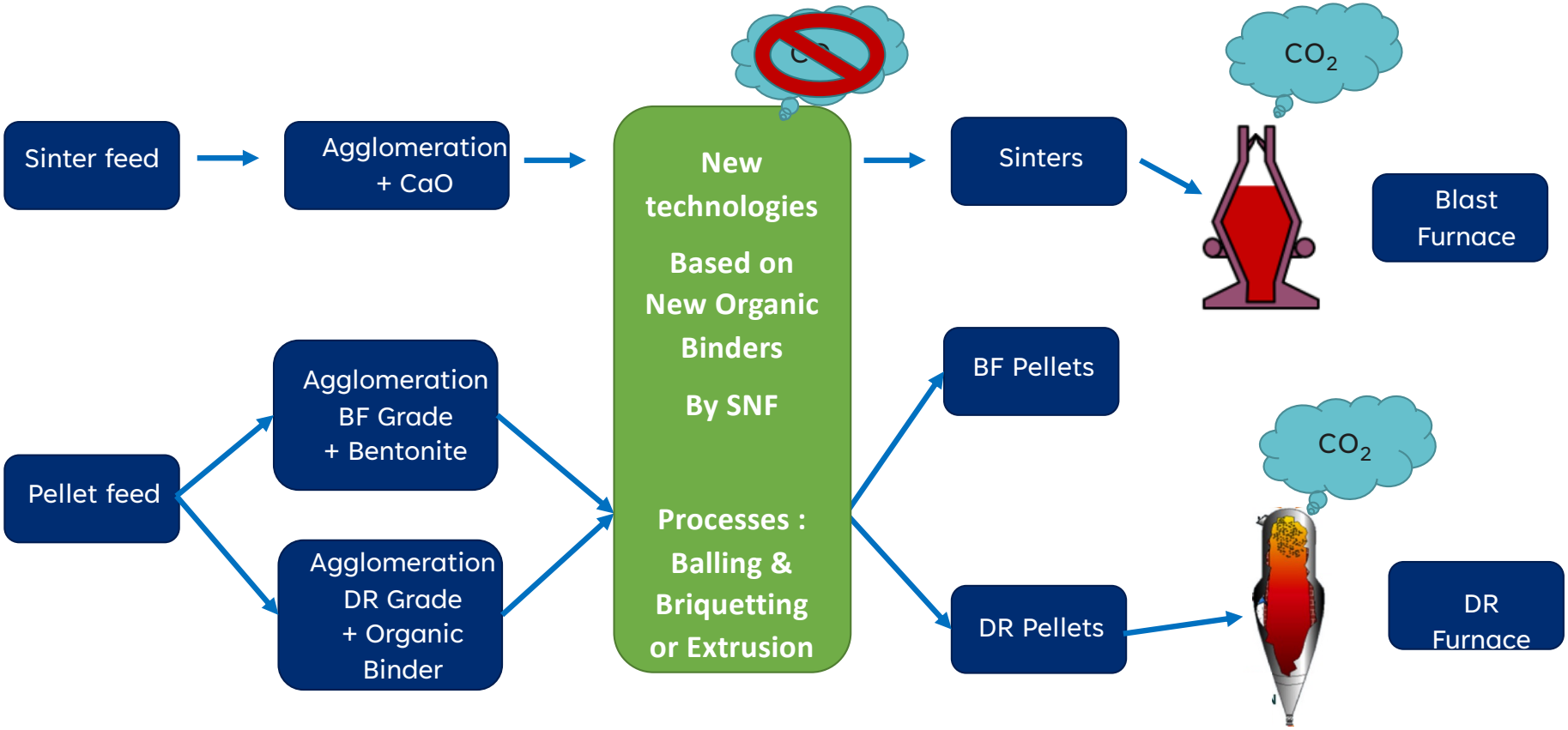
## COLD BONDED PROJECTS




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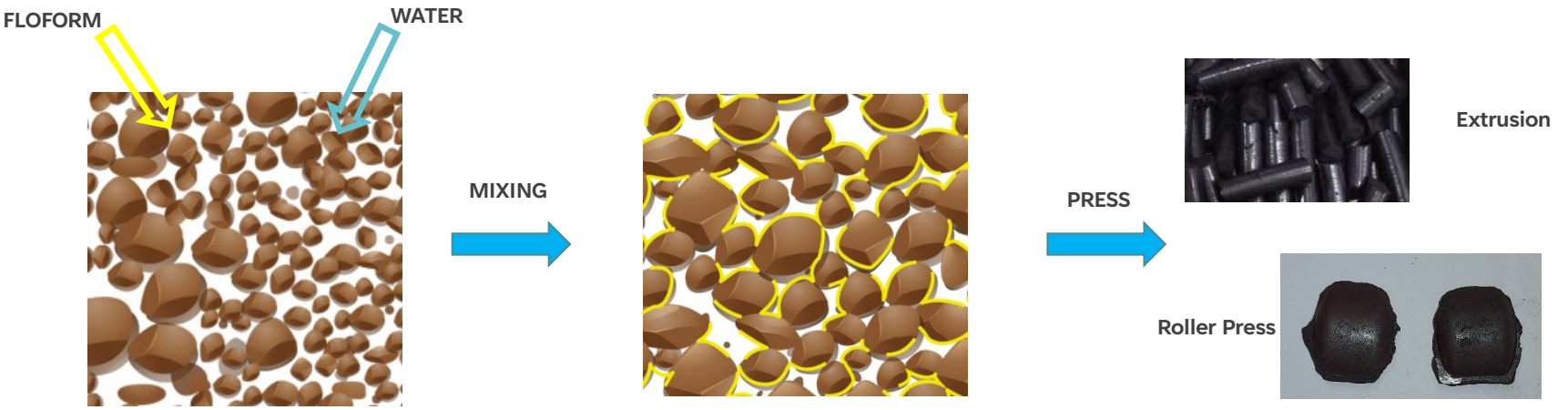
## COLD BONDED PROJECTS




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# Briqueting process
## Plasticity properties given to the agglomerates (briquettes)




1- Materials – heterogenous sizes

2- Polymers hydrates and encapsulates all the particles. "Worm" state

3- Agglomerates are well formed and plastics

- **Polymers gives plasticity and strength to the green briquettes.**
  - Briquettes can withstand many drop after the exit of the press (6 to 10) without breakage.
  - GCS (Green compression strength) is also enhanced

- **Our wide portfolio of polymer allows the fine tuning of the final binder formula.**

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# SNF Pilot plant in Andrezieux



- **SNF has:**
  - **2 rolling presses (5 cm3 and 35 cm3)**
  - **1 pelletization disc (1 m diameter)**
  - **1 lab extruder**
  - **2 intensive mixers (Eirich and Lodige)**
  - **1 oven**

- **SNF can run trials to evaluate the best binding formula with the best size.**

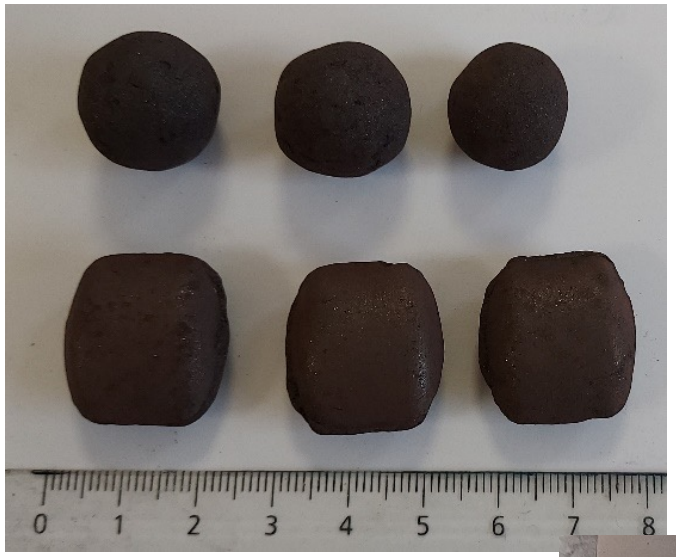
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# Pellets and Briquettes produced at SNF's Pilot Plant.

- **SNF has produced for trails purposes:**
  - **Pellets – cold bonded ones – 16 to 22 mm**
  - **Briquettes:**
    - **2,4 $cm^3$**
    - **5 $cm^3$**
    - **8,8 $cm^3$**

**Pellets and 2,4 $cm^3$ briquettes**




**5 $cm^3$ briquettes**



**8,8 $cm^3$ briquettes**




- **SNF can run trials to evaluate the best binding formula with the best size.**

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# FIRST RESULTS WITH FLOFORM in Cold Bonded Pelletization

- **FLOFORM New formulas have been tested with first good results in terms of green and dry agglomerates.**
  - Trials have been made on compaction wheels or pelletization discs
  - Dosages used are low (less than 5% even 3%), so higher Fe content in the agglomerates.

- **Trials are still on-going.**
  - The first results showed that the SNF cold agglomerates are in the range of the BF requirements, in terms of resistance and permeability
  - Trails are still on for DR requirements

- **Briquettes:**
  - After drying at 105°C, DCS are between 250 kg to more than 500 kg depending on the size of the briquettes

- **Pellets:**
  - After drying at 105°C, DCS are around 200 kg, tests are continuing.

- Inorganic Material is added to enhance the DCS and bring hot Strength to the pellets (RDI, R180, TI)

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THANK YOU !
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