

## Polyethylene

Based on more than fifty years of experience and understanding of the polyethylene market, INEOS Technologies has tailored its Innovene Polyethylene technology to provide our customers Linear Low Density PE (LLDPE), Medium Density PE (MDPE) and High Density PE (HDPE) products that consistently satisfy and exceed the demanding requirements of the market place.

INEOS Technologies offers gas phase Innovene™ G (for LLDPE, MDPE & HDPE) and slurry phase Innovene™ S (for MDPE & HDPE). Both processes have the benefit of low capital cost and low operating cost coupled with the widest product range available.

A unique advantage of a co-investment in Innovene™ G and S technologies is the ability to provide complete coverage across the PE product range. For some investments such an option may prove attractive given that world scale crackers are now capable of manufacturing well in excess of 1 million t per year of ethylene.

INEOS Technologies also offers high value proprietary INcat polyolefin catalysts and services to enhance the Innovene™ polyethylene processes.

With an ongoing research and development program aimed at continually pushing the envelope by extending the product slate and driving down capital and operating costs, INEOS Technologies ensures both Innovene™ G and S technologies will continue to maintain their competitive edge and supplemental value within the world of polyethylene both now and into the future.



### Innovene™ G

At the heart of the Innovene™ G gas phase process is the fluidized bed reactor in which polymer particles grow by polymerisation at low temperatures and pressures maintained in a fluidised state by the upward flow of gaseous monomer and co-monomer.

The Innovene™ G process is set apart from other gas phase processes by the unique catalyst systems used and the proprietary design features of the polymerisation loop and post reactor degassing and treatment. The process enjoys C8, C6 and C4 co-monomer flexibility

The process has low capital cost inherent of a low pressure, low temperature gas phase process. In addition, the exclusive Innovene cyclone technology removes the need for regular loop cleaning and reduces grade transition time.

These combine to provide high on-stream times with high quality product yield giving Innovene™ G the overall lowest lifetime cost for any gas phase process.

Using INcat Ziegler-Natta catalysts, products include narrow molecular weight resins suitable for blown and cast films, injection and rotational moulding, while INcat HPLL metallocene products included high performance LLDPE films. The process has produced over 150 different grades of products with a portfolio that is being continually expanded by units operated by INEOS as well as licensees of the technology.

With recent advances INEOS Technologies now offers world scale Innovene™ G plants with single trains which can produce in excess of 500 ktpa.

These same advances make debottlenecking existing smaller capacity plant both cheap and straightforward. There are examples of single reactor trains being rapidly expanded up to almost twice the original capacity. The unique Enhanced High Productivity process development allows cost effective expansion of all gas phase polyethylene processes.

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### Innovene™ S

The Innovene™ S process is a simple and robust design enjoying best in class economics with low investment and operating costs. With no reactor fouling and hence no required cleaning, the process has proven high on-stream times.

The process utilises proprietary vertical slurry loop reactors in a two reactor system providing easy and efficient transitions between bimodal and monomodal product operations Simplified degassing, no centrifuges and a robust low energy diluent recycle combine to provide outstanding campaign-to-campaign stability with minimal wide-specification product and no wax or oligomers generation.

The simplicity of the two reactor design combines best-in-class economics with market leading MDPE and HDPE products. This catalyst and the Innovene™ S reactor flexibility allows significant and straightforward grade-slate optimisation in response to market changes, and adds significant incremental value through specialty product areas, such as bimodal PE100 pipe.

Further economies of scale are now achievable with recent advances pushing up plant capacity to 600kt per year and beyond.

## Global Licences

### Polyethylene – Global Licences

