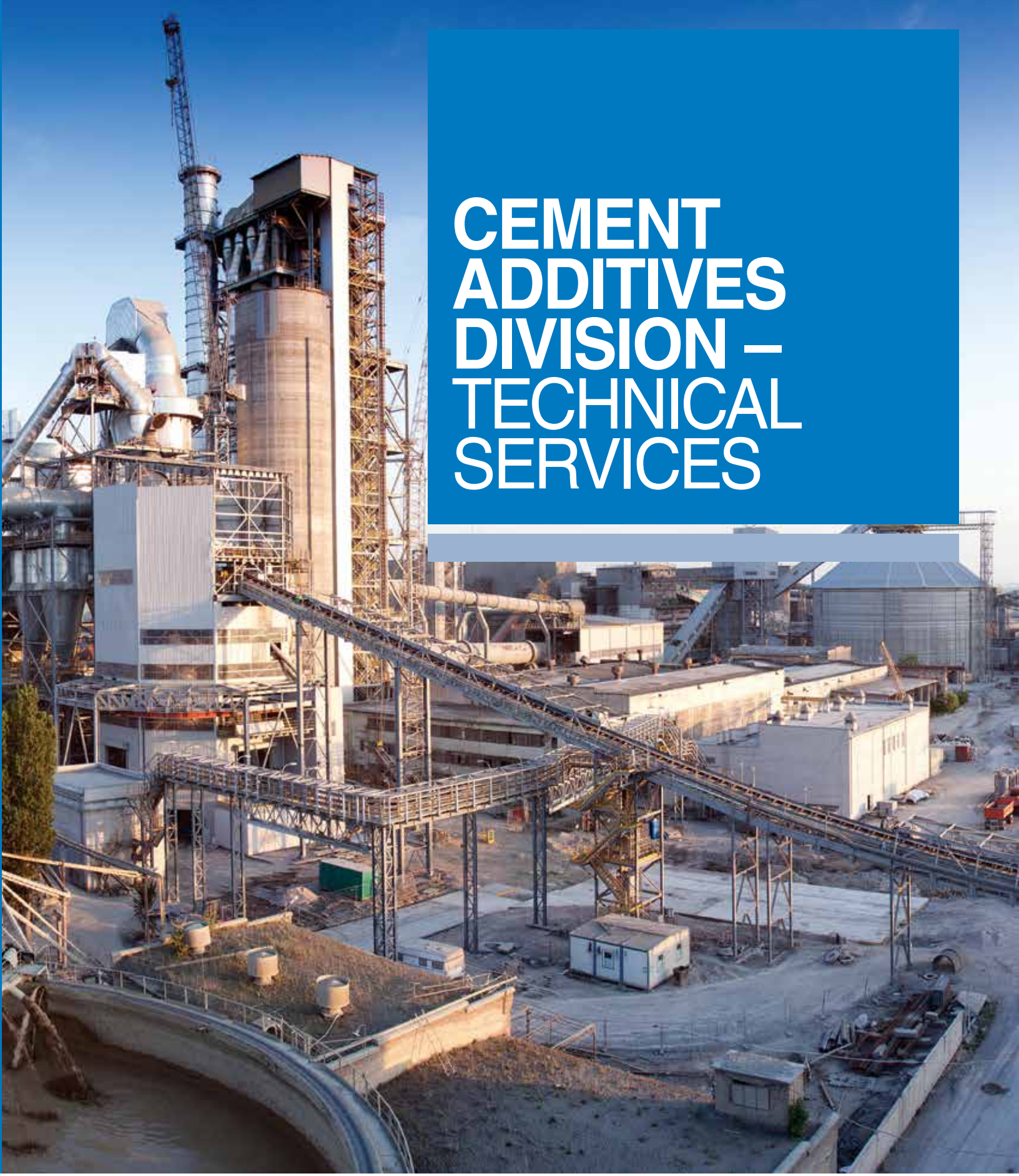


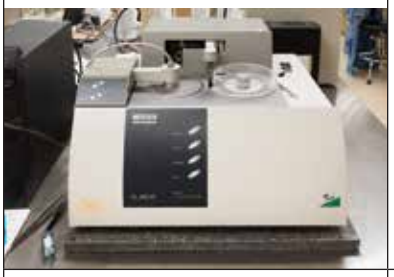
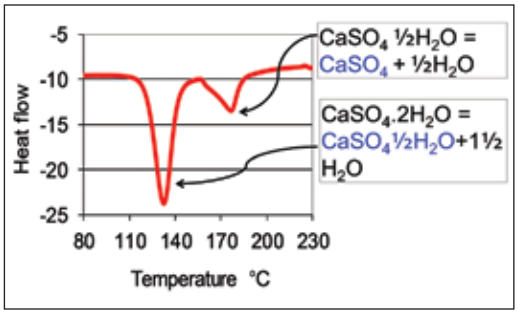
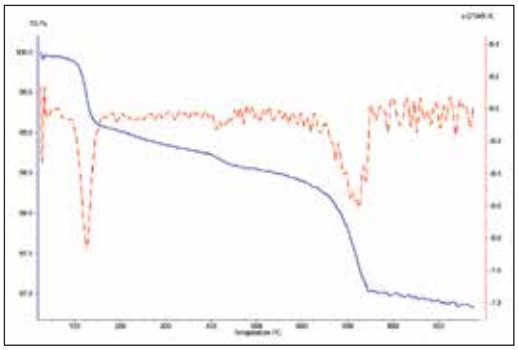
CEMENT ADDITIVES DIVISION – TECHNICAL SERVICES

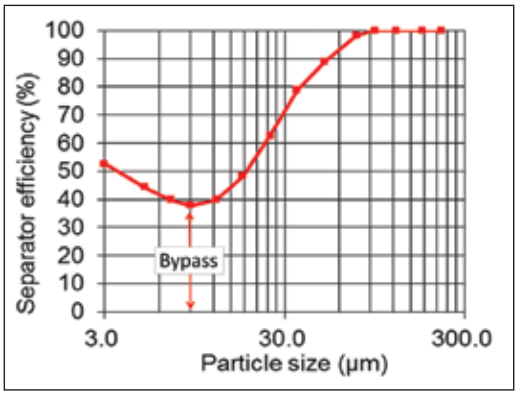
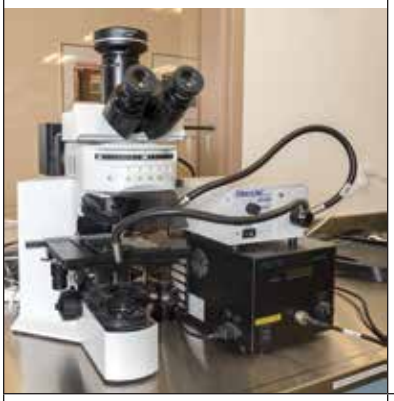
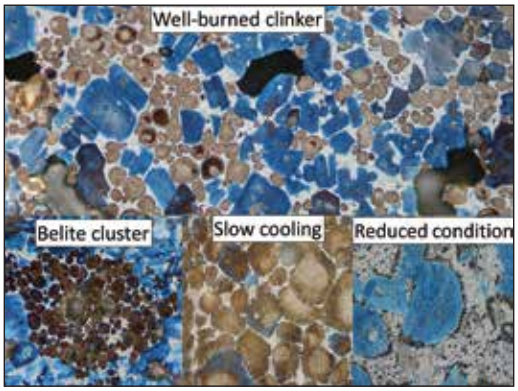
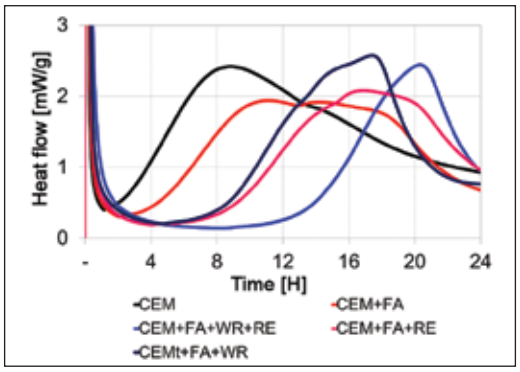
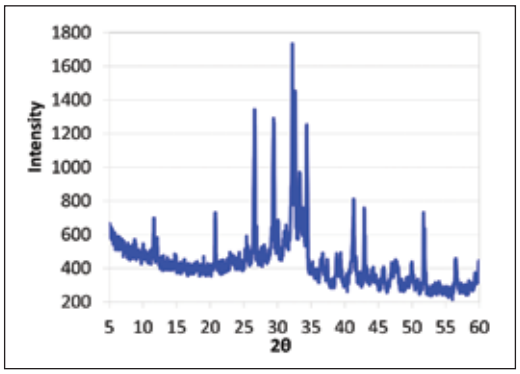
C-ADD MAPEI®
CEMENT ADDITIVES DIVISION

Technical Services initiatives

MAPEI is pleased to announce the offering of essential instrumental testing services to our customers, and provide technical solutions with our commitment to excellence and exceeding customer expectations. The main goal is to assist customers to produce consistent and uniform products, work with customers to optimize cement production cost and increase competitiveness in the marketplace. In doing so, we:

- Investigate and improve the reactivity of mineral phases in the clinker to achieve greater strength development characteristics.
- Provide services to troubleshoot cement quality issues from field applications, including abnormal concrete setting behavior, slump loss, extended strength development, discoloration and surface cracking.
- Conduct in-depth investigation on clinker mineral phases related to crystal size and its distribution, reduced condition, burning temperature, primary and secondary cooling rates, etc., and provide recommendations on the kiln operation conditions.
- Evaluate gypsum dehydration as well as sulfate balance in the finished cement product and also in the cementitious systems containing supplementary cementitious materials and chemical admixtures. Proactively assist cement users to optimize concrete mixture design to achieve optimum material combinations and reduce the risk of incompatibility.
- Provide oil-well cement expertise and support.
- Diagnose finish mill grinding efficiency, and assist customers to increase production and optimize overall economic impact.

Instrumentation tools offered by MAPEI	Technical descriptions	Example
Differential scanning calorimeter (DSC) 	Gypsum dehydration rate is an important parameter impacting cement performance. Severe gypsum dehydration can negatively affect normal cement hydration profile; change hydration kinetics; and modify cement mortar/paste flowability behavior and concrete slump characteristics, etc. The DSC can determine gypsum dehydration rate, provide guidance on finish mill operations and predict its cement performance in concrete mixtures.	
Differential thermal analysis (DTA) and thermogravimetric analysis (TGA) 	Almost all the materials respond to the thermal changes. Thermal analysis is an unique tool for determining mass and energy changes when the materials are subject to heat treatment. During the process, cement signature characteristics –such as syngenite, calcium hydroxide and calcite – are registered and quantified. Such information is frequently used to diagnose many issues with cement quality, storage flowability and pre-hydration.	

Particle size distribution (PSD) and Tromp Curve 	Cement grinding is an energy-intensive process. If separator performance is not optimized, a significant amount of grinding energy is unnecessarily wasted. Therefore, frequent evaluation of the grinding process is important to maintain economic finish mill operation. In addition, grinding aids play a crucial role in the separator efficiency. A well-designed grinding aid can reduce the reject stream and minimize the bypass.	
Optical microscopic analysis 	Burning, cooling and process conditions of the kiln at cement plants are directly responsible for the reactivity of clinker mineral phases and the quality of cement. Optical microscopic analysis directly reveals the burning process of the clinker, including the sizes of the crystals and their distribution in the matrix, kiln atmosphere and reduced condition, burning temperature, and primary and secondary cooling rates.	
Conductive Isothermal Calorimeter 	The Isothermal Calorimeter is an excellent tool to determine cement hydration kinetics and monitor the cement hydration process. The hydration profiles from calorimetric tests can predict sulfate balance, strength development potential and cement compatibility in concrete mixtures as well as helping to troubleshoot concrete performance issues in the field.	
Quantitative X-Ray Diffraction analysis (QXRD) 	The QXRD is an excellent tool to evaluate the mineral phases in materials. It reveals important features of cement minerals including the “true” amount of individual phases, the type of calcium sulfate, and polymorphism of calcium silicates, aluminates and ferrite. The information provides guidance to the cement processing condition. More importantly, it is a powerful tool for troubleshooting performance issues in the field.	

MAPEI PUBLICATIONS AND RESOURCES

- "The Importance of the Clinker Liquid Phases, Particularly the Ferrite Phase in Cement Chemistry," the proceedings of the 14th International Congress on Cement Chemistry, Vol. 43, No. 10, 2015.
- "Well Cement Specification and Performance," the 2nd International Well Cement Conference, Woodland, Houston, 2015.
- "Clinker Mineralogy and Reactivity with the Use of High-Sulfur Petcoke Fuel," the proceedings of the 13th ICCC – International Congress on the Chemistry of Cement, July 3-8, 2011, Madrid.
- "Use of Isothermal Conduction Calorimetric Method for Measuring the Heat of Hydration of Cement," Journal of ASTM International, Paper ID JAI102364, Vol. 6, No. 10, 2009.
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- "ASR – A Review of Mechanisms and Proper Prevention Measures," Proceedings of the 12th International Conference on Alkali-Aggregate Reaction (ICAAR) in Concrete, Beijing, 2004.
- "The Autoclave Soundness Test Mischaracterizes Cement-Fly Ash Blends by Introducing Alkali-Quartz Reaction," Cement, Concrete, and Aggregates, Vol. 24, No. 2, 2002.
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- "Investigation about the effect of chemical grinding aids on cement milling and separation efficiency," 36th ICMA International Cement Microscopy Association Conference, Milan, Italy (2014).
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MAPEI Headquarters of the Americas
1144 East Newport Center Drive, Deerfield Beach, Florida 33442
Tel.: 1-800-324-8154 E-mail: gaids@mapei.com
http://cadd.mapei.com

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