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GRACE Construction Products

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Benefícios na redução do fator clínquer em cimentos compostos com uso de aditivos químicos – Novas tecnologias e processo de customização GRACE



- ✓ Panorama atual
- ✓ Aditivos químicos para cimento
- ✓ Projeto de customização
- ✓ Estudos de caso
- ✓ GRACE – P&D and infraestrutura



Panorama atual

- ✓ Sustentabilidade
- ✓ Viabilidade econômica
- ✓ Energia (disponibilidade?)
- ✓ Materiais alternativos
- ✓ SCC (Adições minerais)
- ✓ Desempenho



Indústria Cimenteira vs Tecnologia Grace

- Aumento de produtividade**
(Menor custo unitário)
- Restrições de capacidade**
- Redução de emissões (CO₂)**

Soluções para a indústria

Aumento do uso de SCMs
Redução de custo vs. clinker; aumento do volume de cimento por tonelada de clíquer; menor emissão de CO₂/volume de cimento

Novos cimentos
Cimento Belita-CSA-Ferrita, Geopolímeros...

Captura e armazenamento de CO₂

Estratégia de tecnologia Grace

Maior nível de SCM
Novas, personalizadas e diferenciadas tecnologias para aumentar a quantidade de escória, calcário, cinza volante, ...

Ferramentas de renovação
Atualização de tecnologias e métodos para mais desempenho e custo de produtos eficientes

Customização e formulação regional
Apóio laboratorial local para os negócios regionais

Mercados adjacentes
Transferência de tecnologia para suporte a negócios globais

Aditivos para cimento

Compostos químicos adicionados na produção do cimento Portland para promover aumento na produtividade (ton/h) e eficiência do processo de moagem:

- ✓ Melhorador de Qualidade do cimento
 - ✓ Aditivo de moagem

1967 HEA2® amine acetate grinding aids patented	1970 TDA® Quality Improver series introduced for blended cement	1990 CBA® Quality Improvers developed and patented	2003 ESE® non-chloride early strength enhancers introduced	2004 SYNCHRO® chromium-reducing additives introduced
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CUSTOMIZED SOLUTION

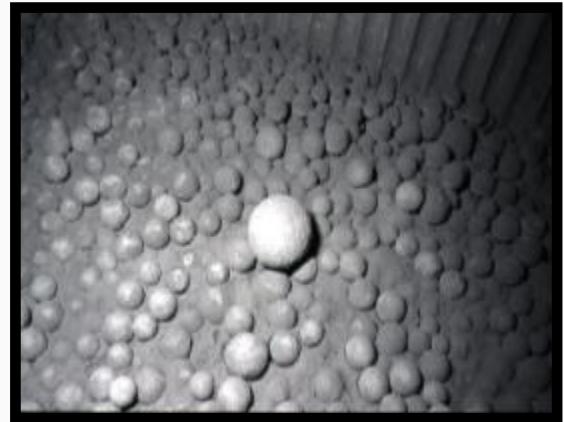
Aditivos para cimento

Performance Additives

Processing Additives

Process

- Reduz os efeitos de coating e pack-set
- Aumento da produtividade do moinho de 5 - 30%
- Melhora da distribuição de partículas (Grinding performance)



Quality

- Aumento da resistência 28 dias → 5-15% ou 2 - 10 MPa
- Aumento da resistência 1 dia → 10-30% ou 2 - 8 MPa
- Diminuição do tempo de pega → 10-40 min.
- Aumento do tempo de pega → 10-120 min.
- Diminuição da demanda de água (concreto) → 2-5%



Desenvolvimentos atuais – GRACE aditivos

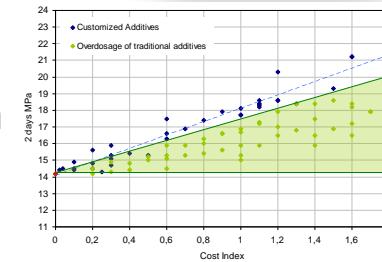
- **Aumentar o teor de SCM no cimento**

Aditivos para aumentar as resistências iniciais e finais de cimentos com cinza volante, escória de alto forno e filler calcário



- **Customização**

Projeto de personalisação do aditivos, de acordo com as características do clínquer.

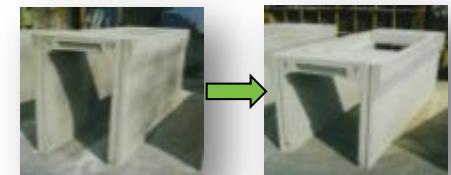


- **Baixas temperatura – aceleradores**

Aditivos para melhorar o tempo de pega em temperaturas baixas

- **Soluções para a mitigação de carbono**

Aditivos para reduzir a migração de partículas de carbono para a superfície do concreto.



- **Aditivos para VRM**

Aditivos para melhorar a estabilidade do moinho vertical e melhorar o desempenho do cimento.



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Customização dos aditivos para cimento

O método:

- ✓ *Uso de ferramentas estatísticas e softwares inteligentes que auxiliam o desenvolvimento do produto ideal*
- ✓ *Uso de modelagem com base em resultados atuais para predizer a melhor performance e custo*
- ✓ *Validação do modelo em laboratório e previsões*
- ✓ *Testes de campo*



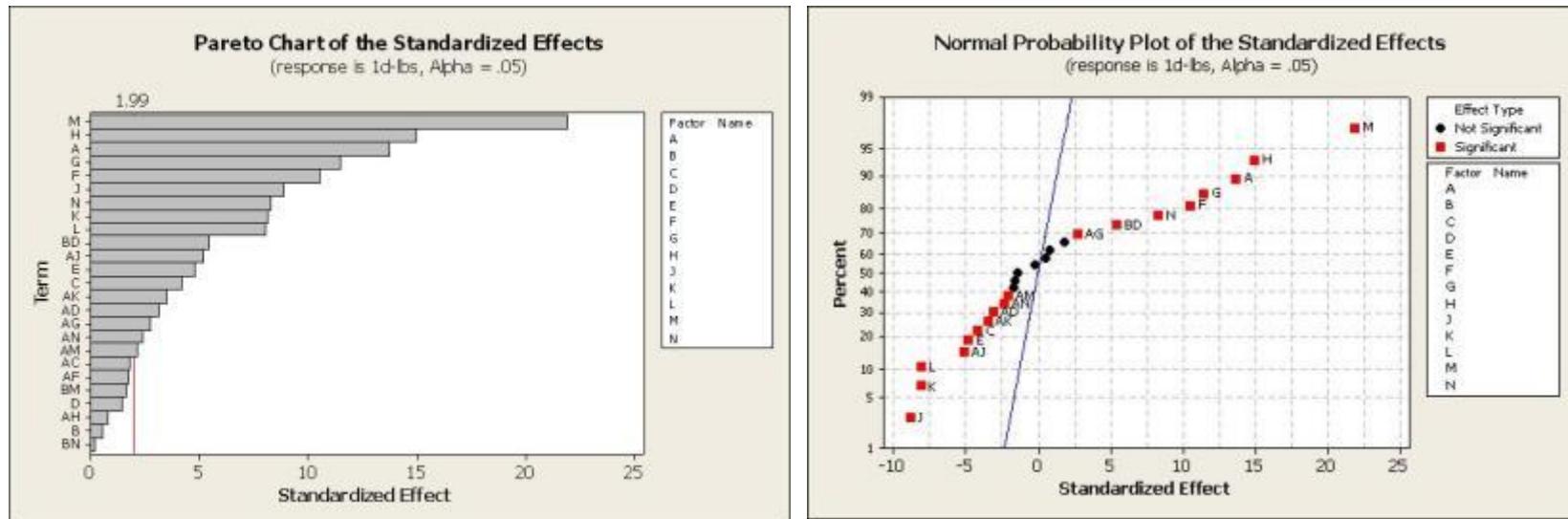
Valores agregados para o fabricante:

- ✓ *Melhor otimização de performance vs custo.*
- ✓ *Formulações mais robustas que as convencionais*

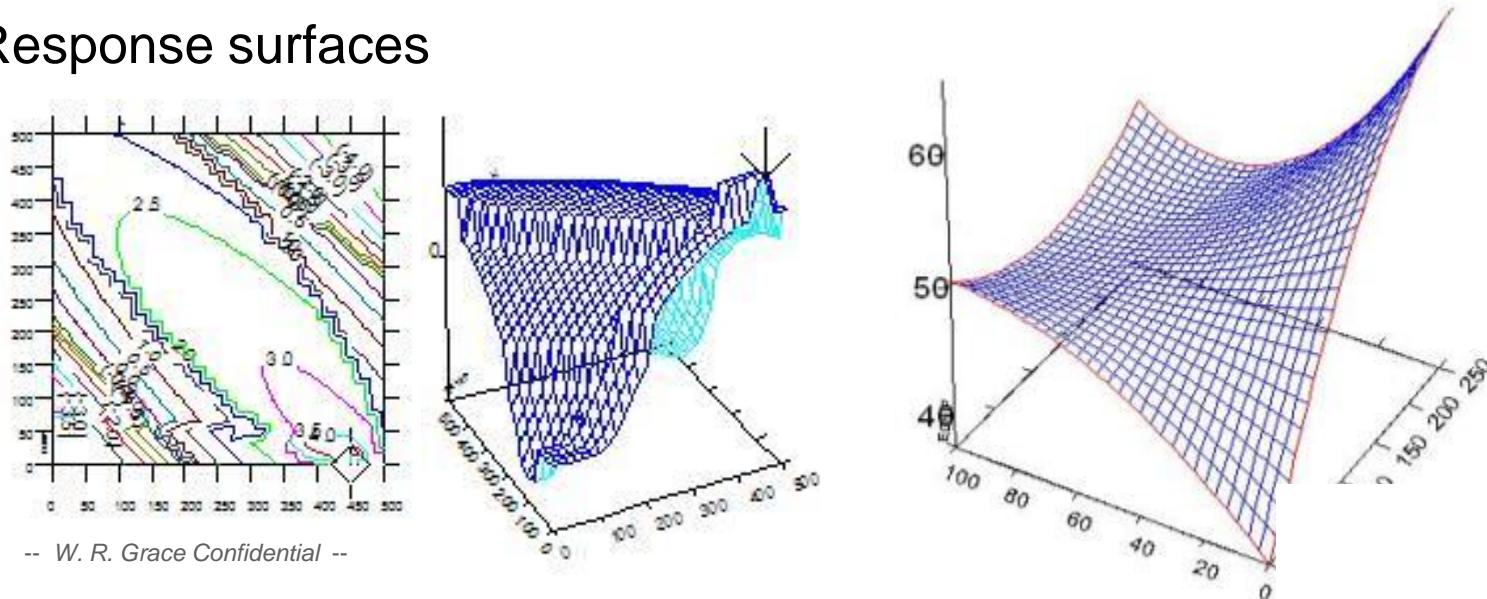


Customização dos aditivos para cimento

Factors



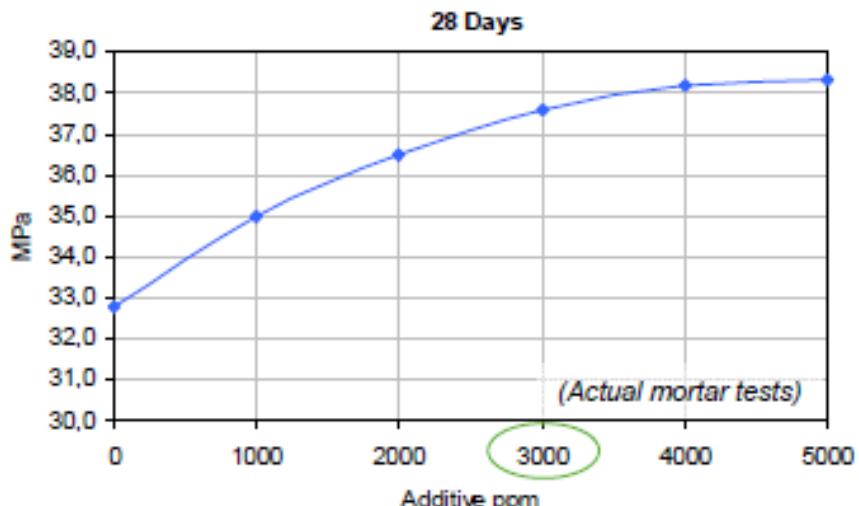
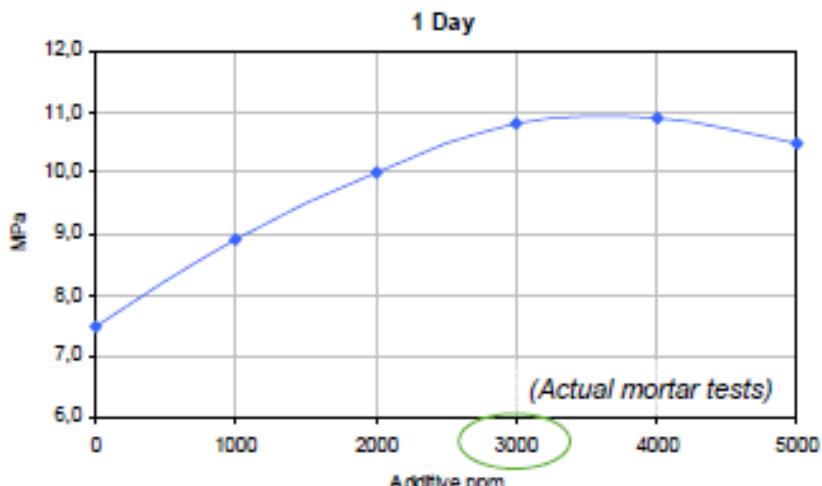
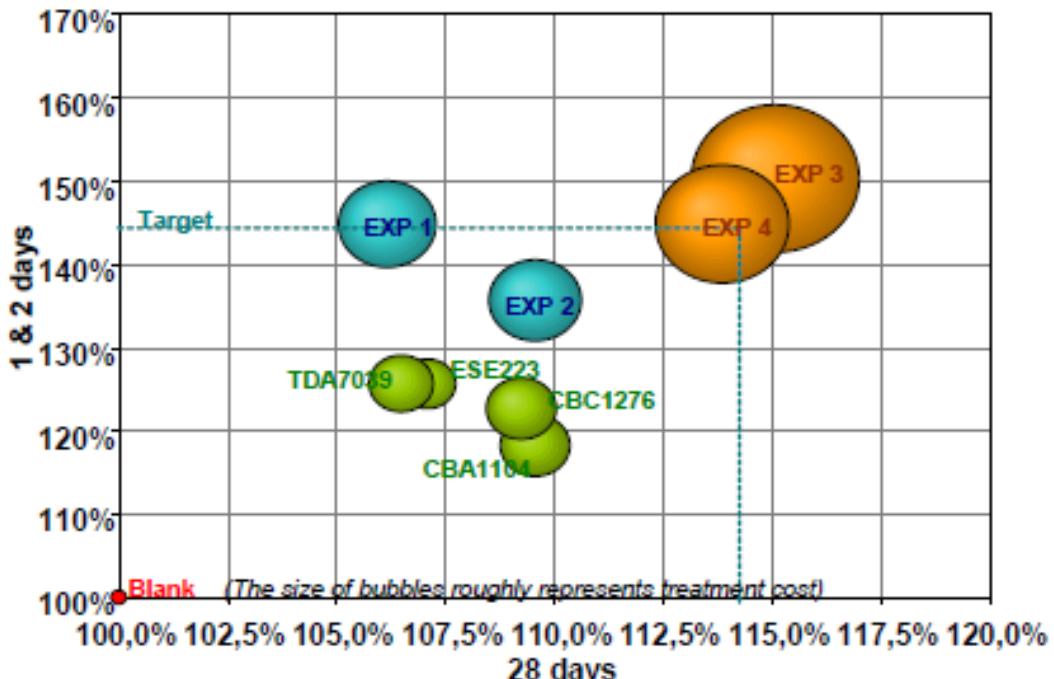
Response surfaces



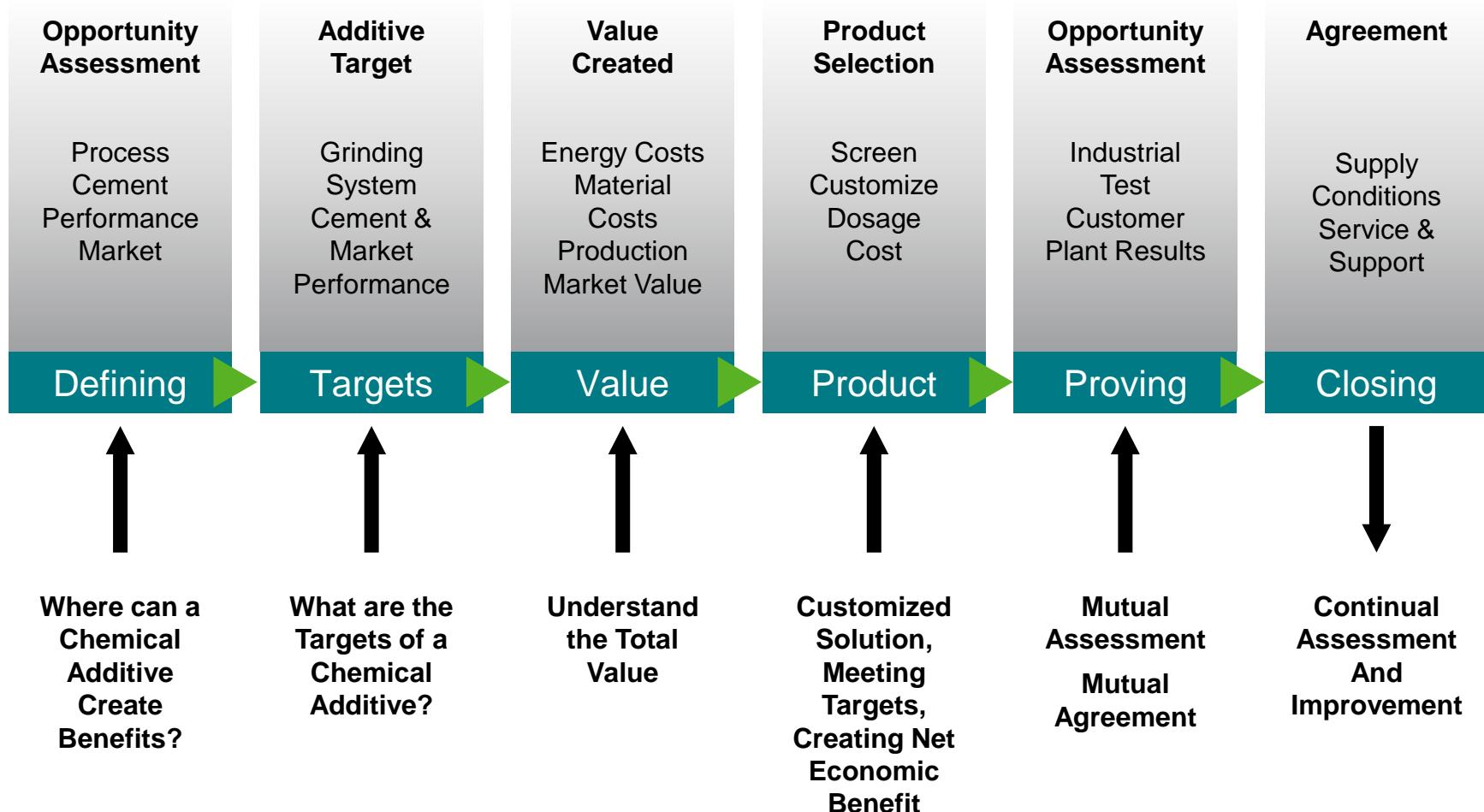
Customização dos aditivos para cimento

Example 1

- European plant producing CEM II/B-M
- Technical target: increase early and late strengths
- Obtained robust performance x cost behavior over a wide range of dosages (500 to 3000 ppm) at all ages
- “A la carte” approach is possible ('pick your strength')



Customização dos aditivos para cimento



Estudo de caso – Impacto no concreto

CEM I 42.5R	HEA2	TDA 7525
Blaine 45 micron %	309 7.3	311 6.7
Initial Set, mins	125	125
Mortar Strength	2d 7d 28d	29.2 42.3 57.8
Concrete Slump (mm)	35 1d 7d 28d	60 20.8 43.8 55.8
		35 22.3 46.6 58.6

Estudo de caso – Pozolana

Additive	None	TDA 771
Pozzolan (%)	28	34
Blaine	342	356
T/hr	51.0	59.5
kWh/t	35.0	30.0
Mortar Strength (%)	2d 7d 28d	100 100 100
Costs (USD/t)	Raw Materials Additive kWh/t Total	34.00 0.00 1.47 35.47
Saving/t Annual Saving		0.67 469,000

Redução Potencial de 8,3 % das Emissões de CO₂ neste cimento,
Para cada 1 M ton : 51,700 ton CO₂ não emitidas na atmosfera

Estudo de caso – Redução fator clinquer

1. ANÁLISIS QUÍMICO

PARÁMETRO	MC 9 CONCRETERO Fecha 2013-09-30 Hora 9 am Adición 6% (Cálculo Lab)	MC 9 CONCRETERO GRACE EXP 203 @ 800 g/t Fecha 2013-09-30 Hora 3 pm - 6 pm Adición 13% (Cálculo Lab)	ESPECIFICACIÓN
RESISTENCIAS A LA COMPRESIÓN			
Relación A/C	%	49,3	48,7
1 dia	Mpa	15,1	14,9
3 dias	Mpa	26,3	Mín. 22,0
7 dias	Mpa	32,5	NA
28 dias	Mpa	43,9	Mín. 41,4
		46,5	

GRACE

Leading specialty chemical and materials company

Founded in 1854

2013 worldwide sales: ~\$3.4 billion

Approximately 6,100 employees

Offices and Manufacturing in over 40 countries

Cement Additive Leader Worldwide

Invested \$60 million in R&D in last five years

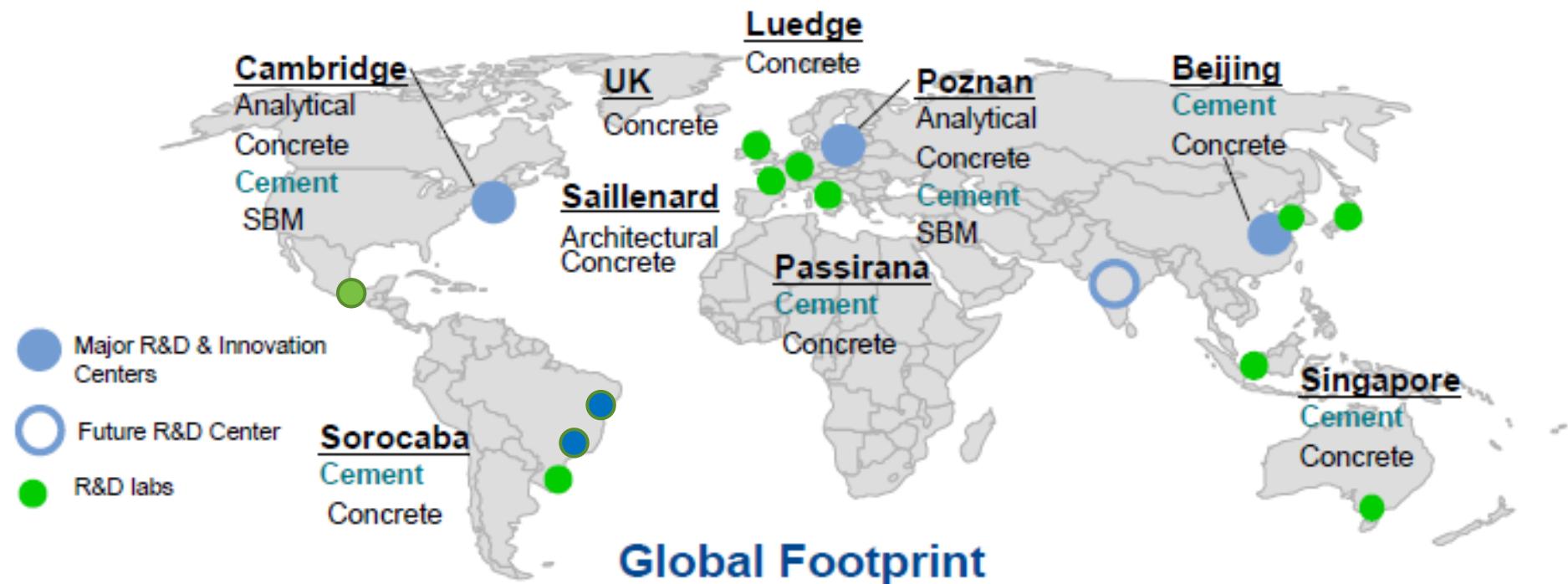
New commercial leadership in LATAM – 50% increase HC for our region



Worldwide Resources - Plants



P&D GRACE CONSTRUCTION



- Centers of Excellence - critical mass of expertise and capabilities serving global needs
- Maintaining strong regional focus
- Developing global programs integrated with local market needs

Leverage and share global resources

P&D GRACE CONSTRUCTION

Full cements and SCMs characterization

- Mineralogical analysis by QXRD (Rietveld analysis)
- XRF elemental analysis
- Soluble alkalis and sulfates
- Free lime
- Particle size distribution by laser diffraction
- SSA by automatic air permeameter (Blaine)
- Residue sieve 45 µm (Alpine)
- Pack set (Grace)
- Sample prep to ensure homogeneity and conservation:
 - V-blender
 - Vacuum packing
- Lab scale clinker crushers and heated ball mills

XRD



Best in class in Cement Testing



Auto Blaine

Vacuum packed cement



P&D GRACE CONSTRUCTION

Semi-automated mortar testing

- Automixers
- Vibrating tables for compaction
- Isothermal calorimetry for reactivity and kinetics
- Computerized compression machines (ASTM C109, EN 196)
- High lab productivity (3,500 mortar mixes/year) at reduced variability ($\text{CoV} < 2\%$)
- Certified lab and technicians (CCRL, NVLAB, ACI)



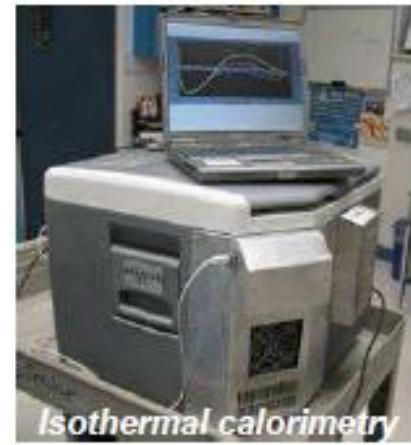
Compression test



Automixer



Vibrating table



Isothermal calorimetry

Best in class in Mortar Testing

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Opportunities to Grow and Lead

In the Grace culture, we roll up our sleeves and take responsibility for ways to meet customer needs and move the company forward. We begin with our Vision, Purpose, and Values. On this foundation, we have built a leadership strategy, spelling out the behaviors we value in leaders and enabling each of us to see a clear path to growth.

Our Vision

Grace strives to be a premier specialty chemical and materials company. We provide innovative technologies and value-added products and services around the world to enhance the quality of life.

Our Purpose

We are dedicated to our customers. They trust us to provide products, knowledge, technologies, services, and the people to make their products work better.

Our Values

Teamwork; Performance; Integrity; Speed;
Innovation:



Why Grace?

A Story. A Promise. An Invitation.

Grace people develop, manufacture, deliver, and support breakthrough and proven products to meet needs in new places and new applications in Catalysts Technologies, Materials Technologies, and Construction Products. Grace's story is a story of quality and commitment; with longstanding relationships and collaboration—with customers, co-workers, partners, and communities. We are large enough to offer you opportunities around the world, and intimate enough to get to know you and allow you to get to know Grace leaders and team members throughout our business segments.

So we invite you to look closely at the opportunities now available with Grace. If you're ready to lead, ready to grow, and ready to make a difference, we'd love to hear from you.

Our passion comes from doing exceptional work and making great things happen. It permeates our rich relationships with customers, co-workers, and our many communities. It is truly a story of talent, technology, and trust.

We invite you to share our passion

If you're brimming with ideas, energy, and passion; if you're talented and ready to learn more, we'd love to hear from you.
www.grace.com

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<https://grace.com/construction/pt-br>

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