

ANTON 安東



Stimulation Technology Center

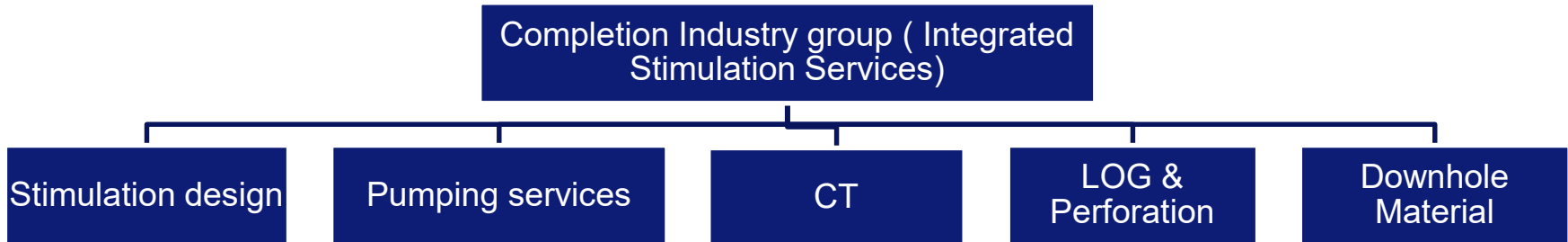
东方智慧 全球分享
Oriental wisdom , Global sharing

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Stimulation Technology Center is specialized in fracturing & acidizing design and onsite services which focus on unconventional oil and gas reservoir resources exploitation with geologic engineering integrated design concept based on the reservoir evaluation . Can provide high quality stimulation services to global customers, including specific reservoir evaluation, stimulation design, downhole material optimization, onsite services, post-frac evaluation , and various matching technologies.

Provide Integrated Stimulation Services



- Stimulation Technology Center: provide fracturing and acidizing design, experimental evaluation and field service;
- CT Service Department: process **12 Units of Coiled Tubing Equipment**;
- Oilfield Chemistry Service Department: provide **complete chemical materials system**; a professional proppants development and production company, **which processes annual productivity of 50,000 tons**.
- Completing Tools Service Department: **provide all technic kinds of fracturing tools**.

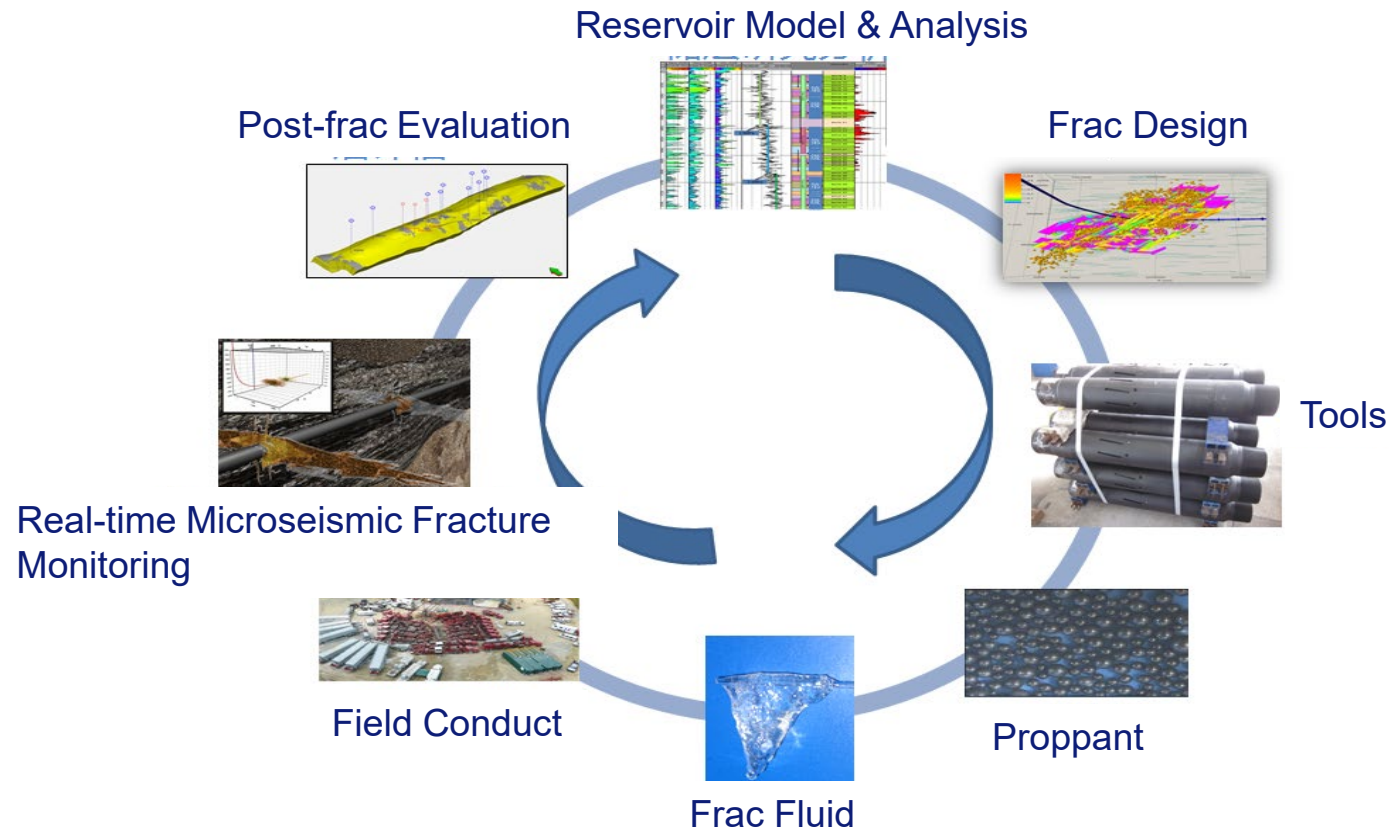


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◆ Stimulation design

Geologic Engineering Integrated Design Concept – Schematic Design Based on Reservoir Analysis



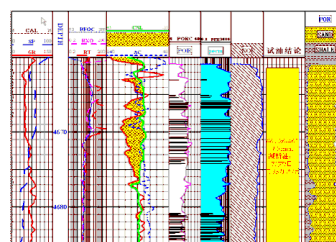
Schematic Diagram of Closed-loop Workflow

◆ Stimulation design

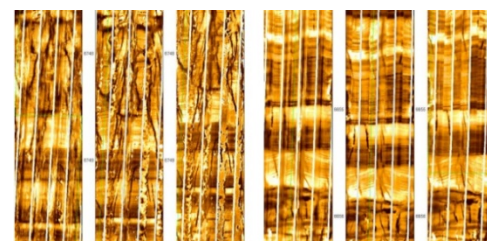
Geologic Engineering Integrated Design Concept – Schematic Design Based on Reservoir Analysis

Provide stimulation design according to the analysis of physical characteristics of oil and gas reservoirs, geological mechanics, fracture characteristics and other geological parameters.

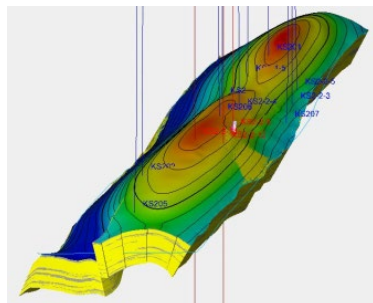
- Geology modeling
- Stress analysis
- Completion and stimulation optimization
- Production prediction and evaluation



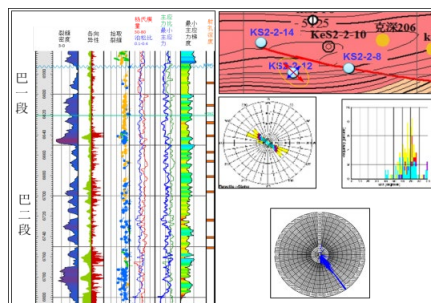
Conventional logging



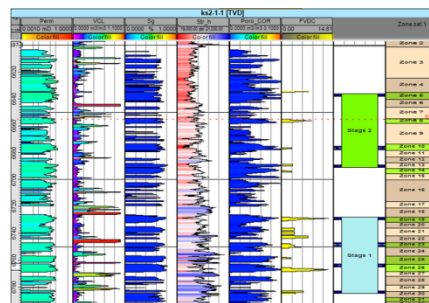
FMI



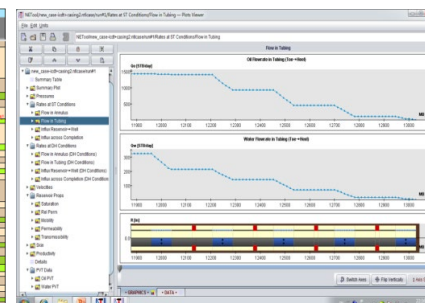
Geology modeling



Stress analysis and fracture analysis



Perforation design



Production prediction

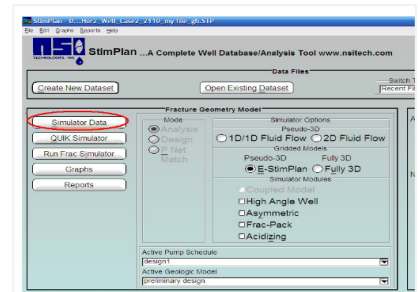
◆ Stimulation design

Equipped with mainstream fracturing, acidizing, reservoir analysis and string analysis software, supplemented by self-developed special software.

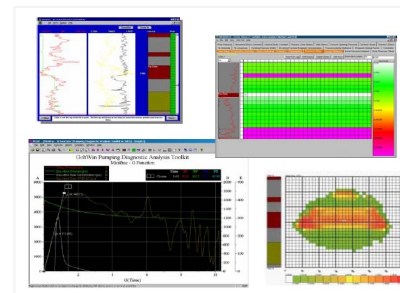
- Fracpro
- StimPlan
- Gohfer
- Stimpro
- Intervals Optimization Of Horizontal Wells
- Stress profile analysis
- Dynamic Production simulation system
- Fracture hit analysis



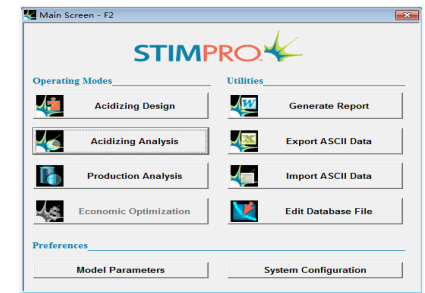
Fracpro



StimPlan



Gohfer



Stimpro

◆ Experimental evaluation and research projects

More than 20 sets instruments which can conduct fracturing fluid evaluation, acid evaluation, proppant evaluation, core flow experiment and comprehensive EOR experiment, can meet the evaluation, test and research work of various fracturing and acidizing fluids, temporary plugging agents, proppant and chemical materials. Can undertake comprehensive scientific research projects from reservoir evaluation, stimulation optimization to post-frac evaluation.

● Reservoir evaluation equipment



● Material r&d and evaluation equipment



● Proppant evaluation system



◆ Characteristic technical system

➤ Sandstone reservoir

- Tight Oil Reservoir Fracturing Technology
- Anton full scale hydro-frac
- Antonoil Compound Temporary Plugging Fracturing Technology
- HTHP Deep Well Fracturing Technology

➤ Carbonate reservoir

- Acid fracturing of carbonate reservoir

➤ Shale gas reservoir

- Antonoil Shale Gas Complex fracture Fracturing Technology

➤ Coalbed methane

- Anton coalbed methane fracturing technology

◆ Matching technology of different wellbore conditions

● Vertical well

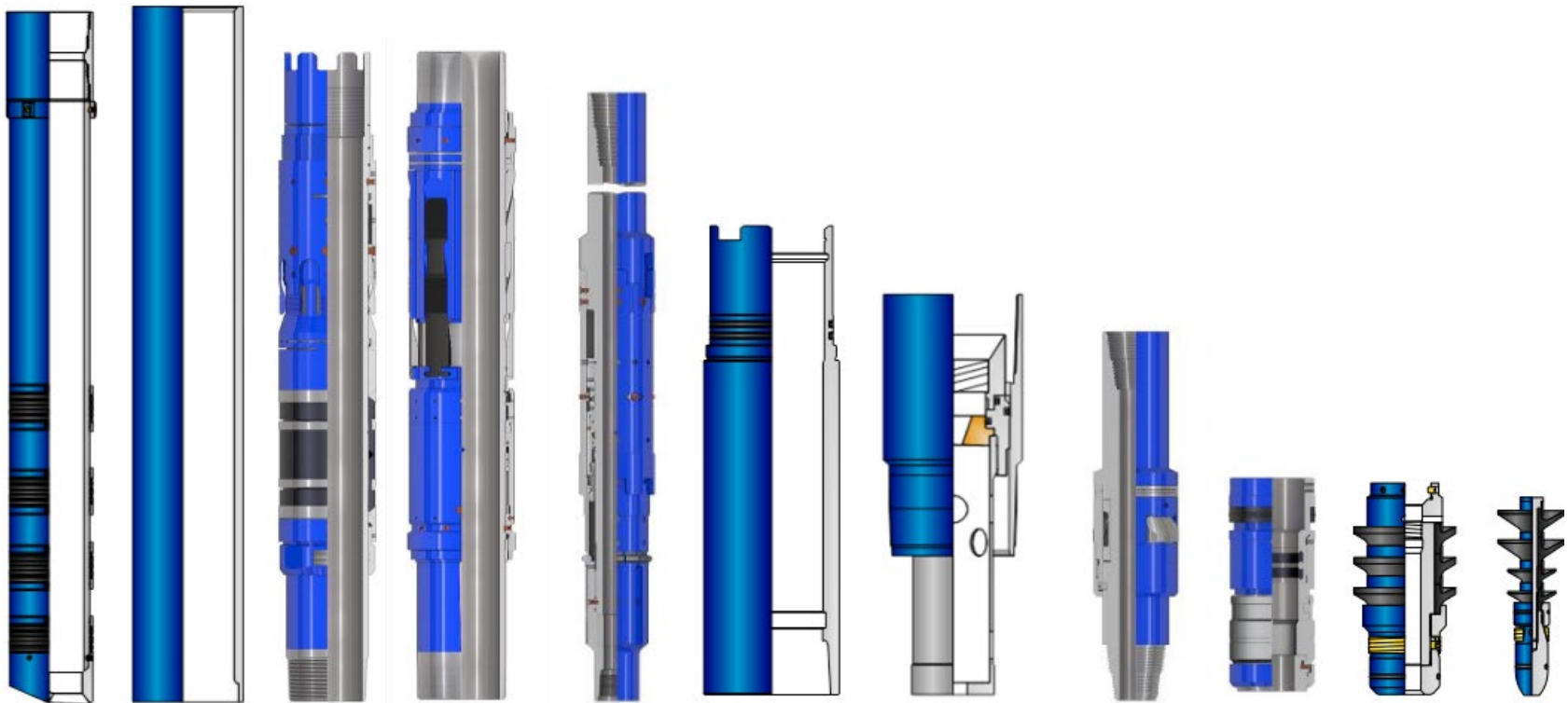
- Tubing+ Annulus packer fracturing technology
- Open hole packer+ sliding sleeve multi-stage fracturing technology
- Temporary plugging agent, fiber diverting fracturing technology

● Deviated well, Horizontal Well

- Open hole packer + sliding sleeve multi-stage fracturing technology
- Clustering perforation+ plug multi-stage fracturing technology
- Coiled tubing abrasive perforating + annulus multi-stage fracturing technology
- Anton step-port full bore sliding sleeve multi-stage fracturing technology
- Dynamic temporary plugging multi-stage fracturing

◆ Tool service

Provide a whole range of fracturing tools matching different type of technology and wellbore conditions.



All Series Completing Tools And Fracturing Tools (API Standard)

◆ Material service – fracturing fluid

Integrates product R&D, production and on-site service, have proprietary intellectual property rights of fracturing fluid and acid system which has been widely used in sandstone, igneous rock, shale, carbonate and other reservoirs, and massive implemented in Iraq, Pakistan, kazakhstan and Ethiopia. etc

1. Ultra low concentration fracturing fluid

- Low Temperature 45 °C
- Middle Temperature 180 °C

2. Clean fracture fluid

- Viscoelastic surfactant fracturing fluid
- Synthetic polymer fracturing fluid
- Cellulose fracturing fluid

3. Ultra high temperature fracturing fluid

- Carboxymethyl guar gum ultra high temperature fracturing fluid (-180°C)
- Polymer ultra high temperature fracturing fluid (-220°C)

4. Anhydrous fracturing fluid

- LPG
- Liquid CO₂
- Oil-base fracturing fluid

5. Foam and emulsified fracturing fluid

- Nitrogen foam fracturing fluid
- CO₂ acid crosslinked foam fracturing fluid
- emulsion fracturing fluid

6. Salt-resistant slick water

7. Weighted fracturing fluid

8. Seawater-base fracturing fluid

9. Changeable phase-permeability fracturing fluid

◆ Material service – fracturing fluid

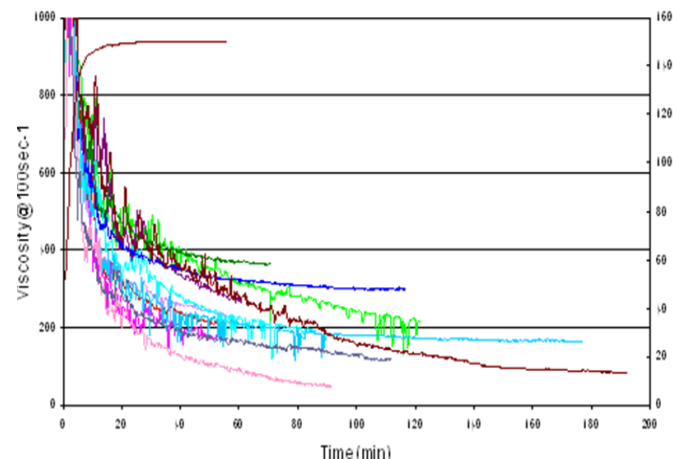
Fracturing fluid characteristics

Temperature Range { Low Temperature 45 °C
High Temperature 180 °C

Tackifier { Low damage, low residue vegetable gum
Clean fracture fluid system



Alcohol-based fracturing fluid
Low temperature fracturing fluid system
Middle temperature fracturing fluid system
High temperature fracturing fluid system
Bubbling fracturing fluid system
Recyclable fracturing fluid



◆ Material service – fracturing fluid

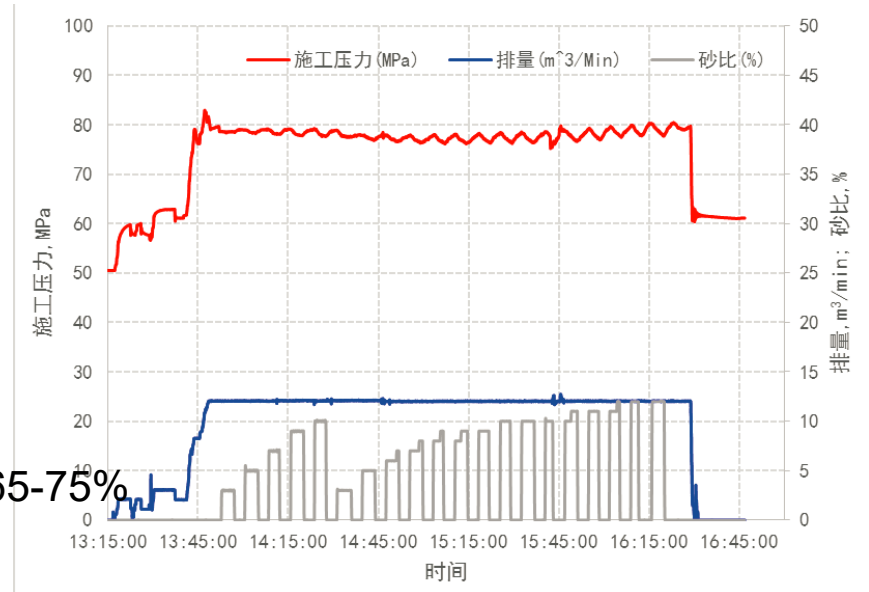
Low friction slick water characteristics

● Main contents

- 0.08-0.1% high-efficiency drag reducer
- 0.2-0.3% cleanup additive
- 0.1% bactericide
- Macromolecular degradation promoter
- Anti-swelling agent

● Main characteristics

- Low friction, resistance-reducing ratio 65-75%
- Instant dissolution, can be mixed on-fly
- No residue, low adsorption, less damage
- Salt - resistant, suitable for highly mineralized water



◆ Material service - Acid

Acid system adapt various of carbonate and sandstone reservoirs (Maximum adaptive temperature 240 °C)



- Conventional acid system
- Micellar acid system
- Gelled acid system
- Drag-reducing acid system
- Foamed acid system
- Crosslinked acid system
- Weighted acid system
- Emulsified acid system
- Diverting acid system
- Complex organic acid system
- Resistant gypsum acid system
- Acid system for sandstone

◆ Material service – Nanometer stimulation technology

● Surfactant

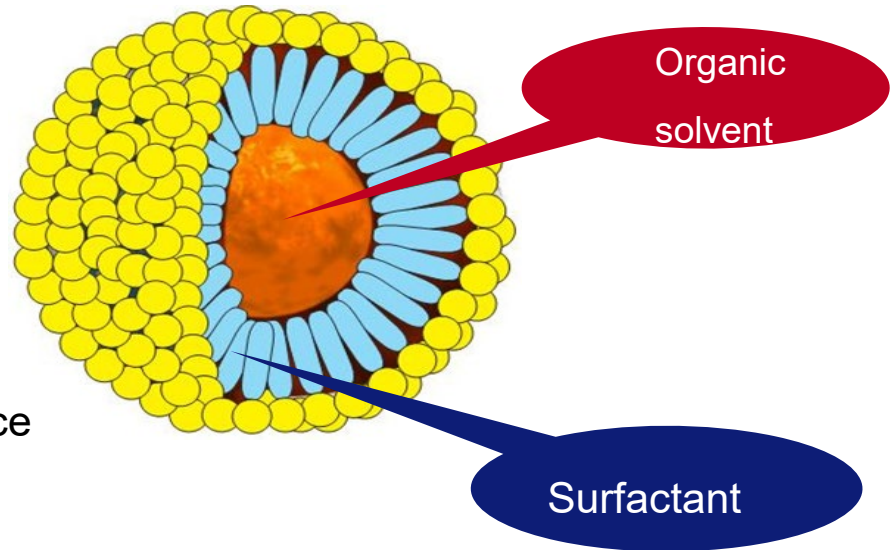
- Reduce surface tension
- Wettability change

● Organic solvent

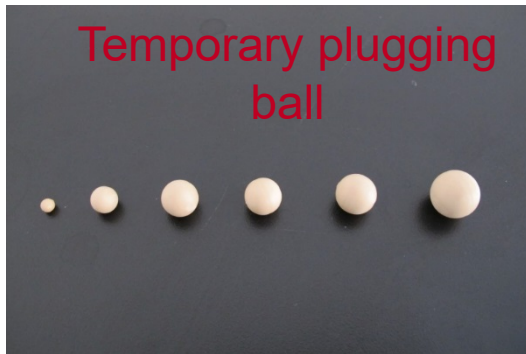
- Dissolve organic precipitation

● Nanoscale droplet

- Deal with uniformly large surface areas with small amount
- Penetrate into the tiny pores of the reservoir



◆ Material service -Temporary plugging agent

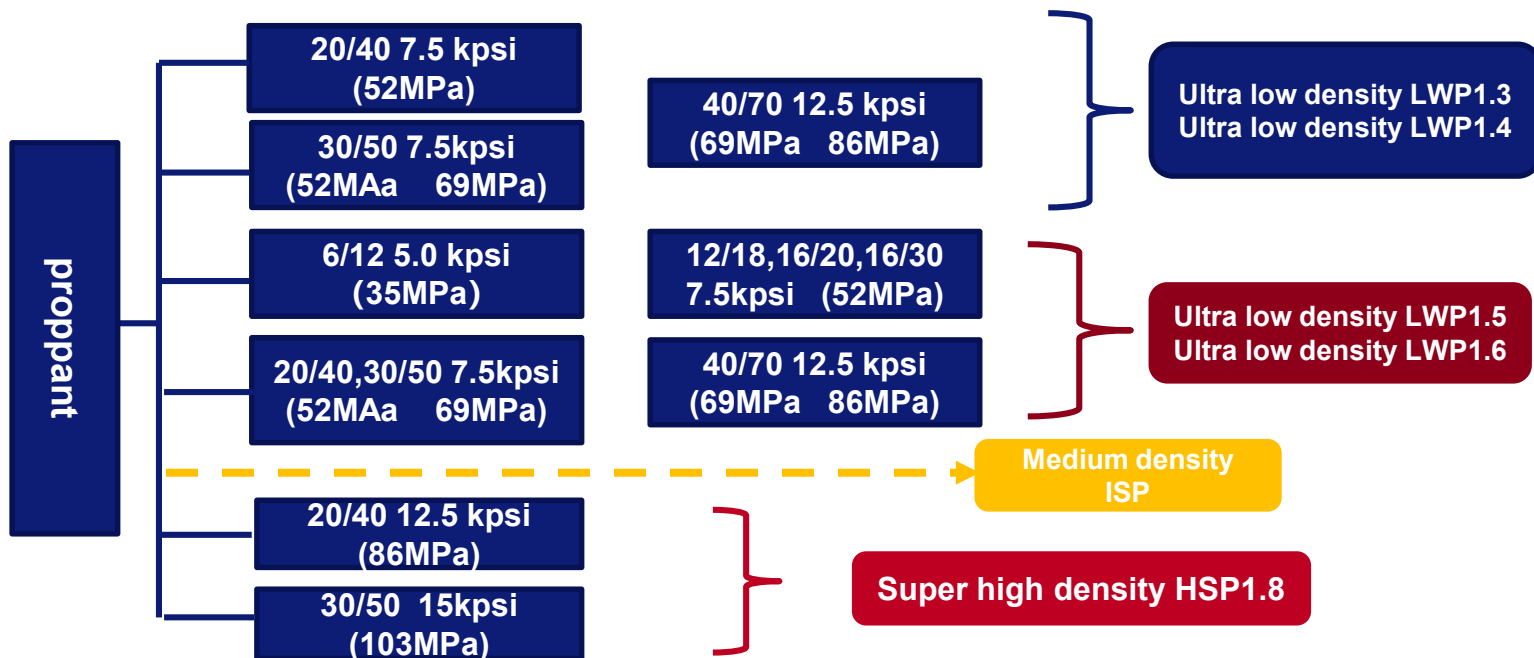


Temporary plugging particle



◆ Material service - Proppant

Provide whole series of Proppant, consists of a professional proppant R&D, production company which has two production lines of environment-friendly proppant and professional R&D and testing laboratory. Annual output can reach 100,000 tons, ultra-low density 1.4 series, low-density 1.6 series and high-density 1.8 series products are in the leading position in the world.



Products Covers The Whole Series of Ceramic Proppant

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Stimulation design and related services summary (by the end of 2018.06.13)

S.N	Area	Reservoir Type	Stimulation Method	Wells	Longest Horizontal Lateral	Maximum Stage Number
1	Sinopec north China	Sandstone	Hydraulic fracturing, Acid fracturing	350	1698m	19
2	Sulige area	Sandstone	Hydraulic fracturing	390	2865m	15
3	Southwest area	Sandstone	Acid fracturing	53	823m	12
		Shale Gas	Hydraulic fracturing	30	1300m	13
4	Xinjiang area	Carbonatite, Sandstone	Hydraulic fracturing, Acid fracturing	131	1500m	13
5	North China	Sandstone	Hydraulic fracturing, Acid fracturing	84	850m	6
6	Northeast China	Sandstone	Hydraulic fracturing, Acid fracturing	75	1289m	13
7	Zhejiang oilfield	Carbonatite, Sandstone	Hydraulic fracturing, Acid fracturing	50	1200m	12
8	Iraq	Carbonatite	Hydraulic fracturing, Acid fracturing	4	/	1
9	Pakistan	Sandstone	Hydraulic fracturing	13	/	3
10	Kazakhstan	Carbonatite	Hydraulic fracturing, Acid fracturing	5	/	2
11	Ethiopia	Carbonatite	Acidizing	5	/	2
Total				1190	/	/

- The first horizontal well open-hole staged acid fracturing technology in China was implemented in the Sichuan Basin.
- Staged acid fracturing of horizontal well in Xinjiang basin, **the deepest depth is 8008m.**
- ANTON took the lead in introducing the foreign shale gas-slick water volume fracturing technology to complete the first fractured shale gas horizontal well in CNPC.
- in Ordos basin, the maximum sectional number is **19 stages, 40 open hole packers**, exceeding **200 wells** completed in total.
- **2016**, completed adding sand fracturing in carbonate reservoir **in Hafaya, Iraq. This is the first adding sand fracturing well in Iraq**, which has an obvious effect.
- 2017, completed adding **sand fracturing in carbonate reservoir** for 5 wells. Obtain a high yield with 220,000 cubic per day per stage.
- In 2018, we promoted **Anton special re-fracturing technology**(**Anton full scale hydro-frac, Composite temporary plugging re-fracturing** , Nano stimulation etc).

The first horizontal well open-hole staged acid fracturing technology in China was implemented in the Sichuan Basin: **W X-1**

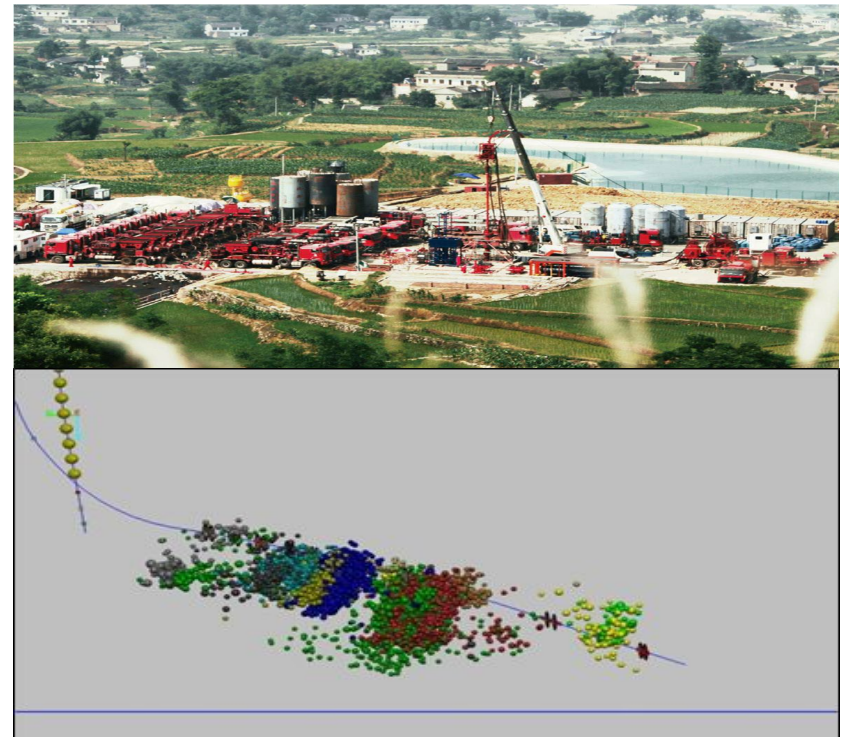
The first shale gas horizontal well staged fracturing construction in China:wei **X-1** well

Used rapid drilling plug + sandblasting perforation staged fracturing technology

Injection method: casing fracturing

The main construction parameters as follows.

- Stage number :12 stage
 - Design Displacement:15.9m³/min
 - Total amount of fluid :24640m³
- The total amount of sand:1041.2t



Shale gas drilling and stimulation integrated service:J -2

Change idea: Volume fracturing idea

stage	fluid volume	output volume	pressure	Sand ratio	sand-carrying capacity
prepad fluid	780	15	44.1-56.1	3—6	5.2 (100mesh)
carrying fluid	2543.2	15-16	49.5-85.1	3—16	34.3 (40/70mesh)
displacing liquid	20.3	16-1.6	83.4-59.9	/	/
Slickwater		2642.5m ³	linear gel		701m ³
Total amount of fluid		3343.5m ³	Total amount of sand		39.5m ³

Shale gas drilling and stimulation integrated service:J -2

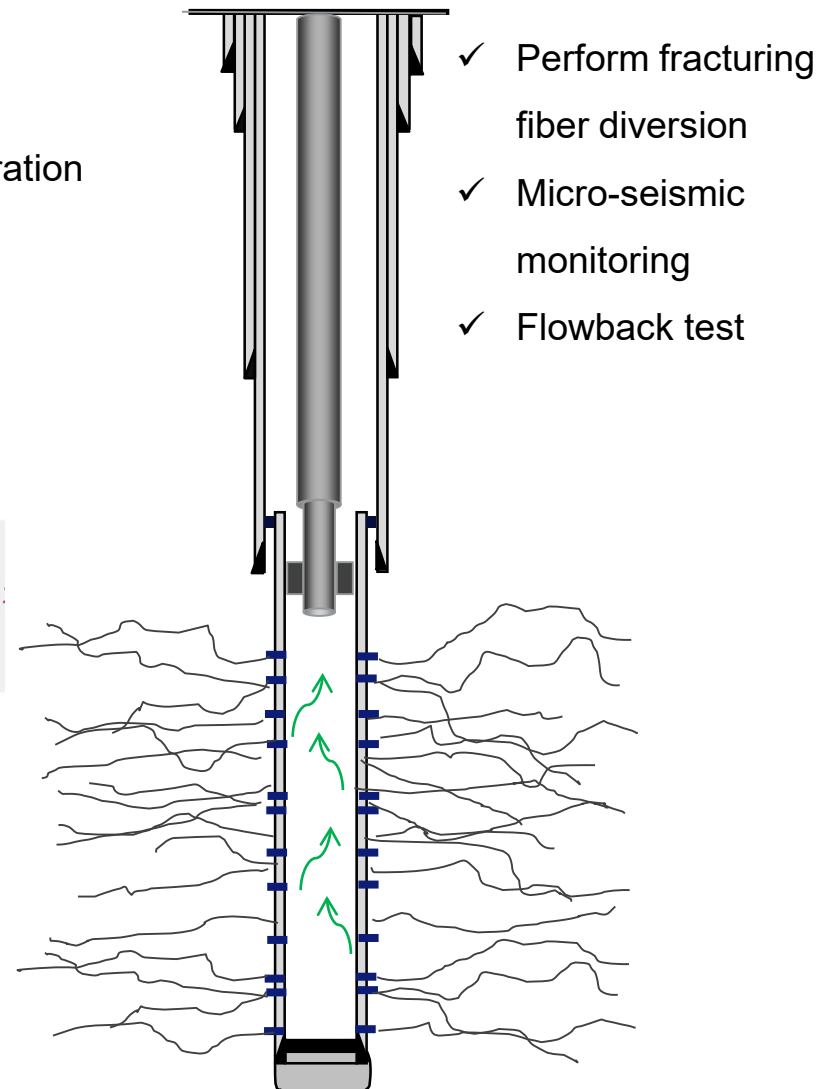
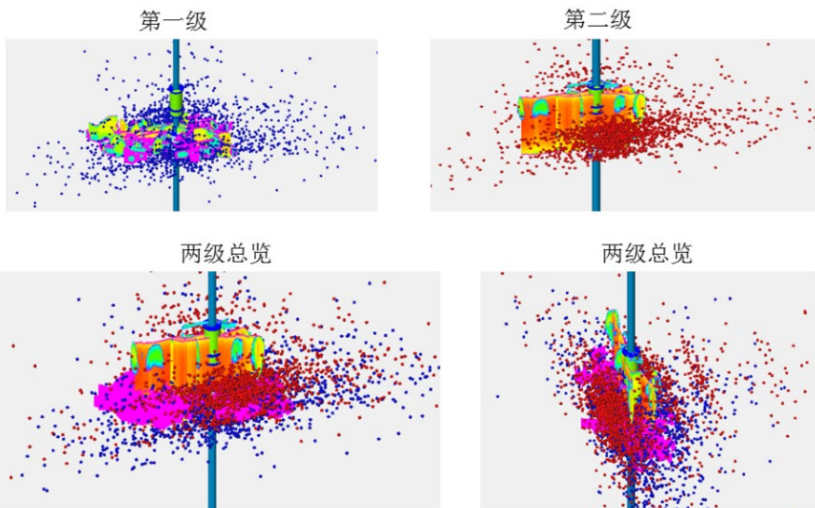
Frac idea: Volume fracturing idea



China Tarim

2013, completed 14 wells **SRV volume frac** operation in Xinjiang basin and **the temperature is 170°C**.

Gained the second prize of CNPC.



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THANKS!

Helping others succeed...