Is ExxonMobil's Proprietary Proppant a One-Off Advantage, or Can the Rest of the Unconventional Sector Follow?

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It's been about a year since ExxonMobil revealed that it was using an enhanced version of petroleum coke (petcoke) as a lightweight **proppant** additive in the Permian Basin.

ExxonMobil reports between 7 and 20% uplift in crude production from wells treated with petcoke proppant compared with baseline offsets, and outside analyses support the claims.

Though the reported results have been undeniably positive, the impact that this technological development will have on the direction of the wider **unconventional business** is far from certain. What the Houston-area-based oil company has made clear is that it believes reaching the next rung of tight-oil recovery is unlikely to come from pumping standard in-basin **sand** alone.

An emerging technology known as the PropCoater involves a trailer-mounted unit that coats proppant sand with high-viscosity friction reducer in an effort to improve pump efficiency and proppant transport. The results included double-digit production gains. Source: AquaSmart Global.

Some in the completions engineering space have been making a similar case for more than a decade, and there's no shortage of case studies on either lightweight proppant (i.e., lighter than sand) or microproppant (i.e., smaller than sand) deployments to be found in industry literature. But the argument now carries the weight of an endorsement from the largest operator in the Permian—and this has not gone unnoticed among the companies developing competing technologies.

Among those pleased to hear of ExxonMobil's success is Terry Palisch, chief technology officer of specialty proppant supplier Carbo Ceramics and the 2024 SPE President.

"ExxonMobil has elevated this discussion from a few companies and a few experts to the front and center," he said. "They have shown that by putting lower-density material in their fractures, they can reportedly prop open areas that have not been propped before."

Carl Montgomery is another long-time completions expert who has been promoting the use of lightweight microproppants for many years. For most of that time, however, the industry has been reticent to invest in the additives because of their premium pricing.

"It's been a very hard sell," said Montgomery, the CEO of the completions-focused consultancy Fracdog. "But this work that ExxonMobil has done with petroleum coke, it's kind of changed that and we're getting a lot more calls because people are more interested in it."

ExxonMobil first disclosed the proprietary proppant, an upgraded variety of petcoke made at its North American refineries, in late 2024. Interest grew further during the 2025 **Unconventional Resources Technology Conference (URTeC)** in Houston, where **ExxonMobil engineers outlined the material's superior transport properties.** According to **URTeC 4264319**, the lightweight petcoke reaches deeper into fracture networks than in-basin sand and increases propped area by 20 to 40%.

ExxonMobil issued another update on 31 October during its third-quarter earnings call, noting that it has used the material in about a quarter of its wells over the past year and expects to treat half of its new wells with it in 2026.

The scale of ExxonMobil's plans, and the expectations around them, have caused some to scrutinize public data to verify the results. This includes analysts at Wood Mackenzie, whose recent report on the matter was highlighted by ExxonMobil during its October call.

The energy consultancy pored over public data to confirm that petcoke has increased uplift by 15 to 20% in many of the wells treated so far. Wood Mackenzie also said it believes "widespread adoption" of petcoke by ExxonMobil could represent a quarter of the $3-billion synergy target the company is aiming for following its 2023 acquisition of Pioneer Natural Resources.

The banner results have raised the question of whether ExxonMobil has gone where others cannot easily follow.

While ExxonMobil has not disclosed its economics, bulk power-plant-grade petroleum coke in the US has recently traded between $70 and $80 per ton.

ExxonMobil previously told *JPT* it is using a more refined form of petcoke known as Flexicoke and expects to pump about 2 million tons of the material into the Permian each year at peak. The company is understood to be producing it at a substantially lower cost than spot prices because of its integrated advantage, while comparable alternatives may cost up to five times more.

Robert Clarke, vice president of upstream research at Wood Mackenzie, discussed the petcoke proppant and the firm's analysis at the **SPE Permian Basin Energy Conference** in Midland, Texas, in November. He told attendees that the petcoke "is being used at great scale and at a great mass," and that its rapid uptake by the supermajor means "many companies are now revisiting neutral-buoyancy proppant."

The obstacle that eager followers are said to face comes back to price. Wood Mackenzie based

A microproppant called Nanomite is five times smaller than the 100-mesh sand commonly used to stimulate horizontal wells and is credited with boosting early production by as much as 20% in several unconventional basins. Source: Carbo Ceramics.

its analysis on bulk petcoke sourced from one of ExxonMobil's Canadian refineries and estimates that the combined material and logistics costs are about $200,000 per well. Clarke explained that matching ExxonMobil's concentration using a third-party lightweight, or neutrally buoyant, proppant may approach $1 million per well.

ExxonMobil has also been explicit that it will not act as a supplier and intends to protect its patents. As a result, unconventional producers and vendors are back where they started, working to unlock more fracture area without letting costs outweigh the benefits.

The situation has prompted a fresh look at vendors pursuing different routes to the same goal.

The list includes Oil Field Packaging (OFP), which works with Halliburton and has built a substantial track record, and the newer entrant AquaSmart, which introduced a sand-coating system about 2 years ago that applies friction reducer to regular sand to improve its transport and placement.

Talk of Bigger Doses

Carbo produces several proppants designed for improved mobility, including a ceramic microproppant called Nanomite.

Introduced several years ago, Palisch said Carbo is stepping up production of the 325-mesh-size proppant due to increased demand from operators looking for extra uplift. He added that ExxonMobil's petcoke benefits from low density, whereas Carbo's microproppant gains its transport edge from its much smaller particle size.

"What is interesting is that we started out using 5,000 to 10,000 lbs per stage, or 5 to 10% by concentration, and much of the demand was driven by treating pressure concerns," he said. "Then we did some work and wrote some papers where we showed why we think we are seeing an extension of production decline curves, so the wells saw more production. And now people are asking us that if 5 to 10% works, what about 10 to 20%?"

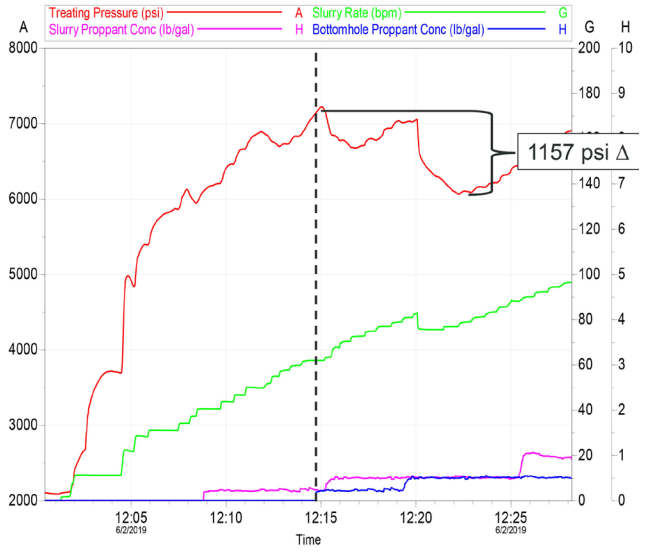
One of those papers, SPE 212341, coauthored by Palisch in 2023, details a case study with Hess Corp. from the Bakken Shale in North Dakota in which wells treated with Carbo's ceramic microproppant produced an average of 13% more oil after more than 300 days compared with offset wells that used no microproppant. Carbo has since reported that the material is delivering uplift of 20% or more in multiple basins.

One of the key concepts that Palisch said is important to keep in mind about lightweight proppants is their apparent ability to self-segregate in slickwater fracturing fluids. This means that despite being mixed together, heavier 100-mesh sand will settle in the fracture network earlier than a lightweight proppant.

Palisch pointed out that before ExxonMobil cited this feature of its lightweight proppant, Chevron had also highlighted its observations of self-segregation in a slot flow test that was documented in a 2021 paper, SPE 204135.

That work did not focus on proprietary lightweight proppants but compared more traditional sand sizes with a 200-mesh sand, which has a grain diameter about twice as small as 100-mesh sand.

The Chevron study concluded that depending on the size of the proppant, the settling rates can



This chart shows a drop of more than 1,100 psi in treatment pressure when the microproppant MP-D1 was dropped into the wellbore, which lowers overall pumping horsepower, thus reducing surface completion costs. Source: Oil Field Packaging/Halliburton.

exhibit large variations. When using 100-mesh and 200-mesh together, Chevron's authors said "self-segregation of proppant provides increased near-wellbore conductivity, larger partially propped area, and enhanced wellbore connectivity with proppant pack dune, thereby achieving the desired goal of larger conductive surface area and increased wellbore connectivity."

Aside from these benefits, the idea of self-segregation is attractive because for years operators have struggled with how to apply advanced proppants. Some believed you need to pump them ahead of the regular sand, known as a lead-in technique, or pump them at the end of a stage, known as a tail-in. But when used to increase conductivity, maybe they can be pumped at the same time and let self-segregation take care of where the proppant eventually ends up.

Palisch said that with two supermajors now "shining a light" on the issue of self-segregation, the rest of the industry should take notice. "This pushes us to do more diagnostic work to understand what is happening. Let's confirm why petroleum coke is performing the way it is, and let's confirm why a microproppant is helping, so we can improve our designs and achieve more efficient placement."

44,000 Stages and Counting

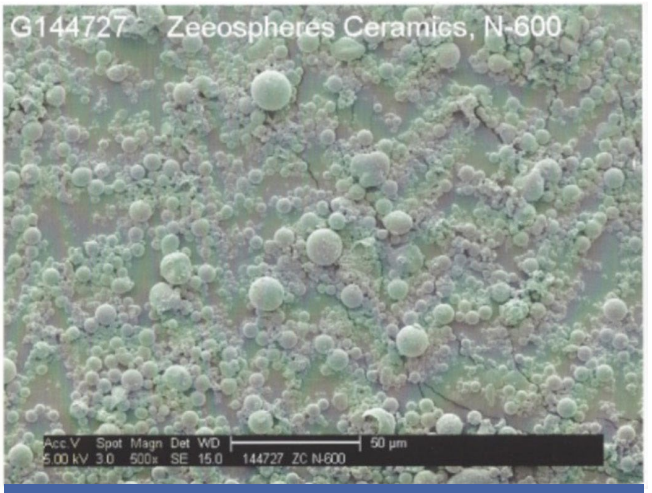
Denver-based OFP supplies a microproppant known as MP-D1, which is sold exclusively through Halliburton. The material is produced at 13 plants in the US and one in Canada and has been pumped into more than 44,000 stages since 2018. And like other firms in this space, OFP saw a spike in interest following ExxonMobil's announcement.

Jason Shrode, a manager at OFP, often carries small sample vials to show engineers what the treated material looks like once mixed. Delivered to location as a dry powder, MP-D1 becomes a milky-white suspension when hydrated, a result of the microparticles remaining buoyant in he fluid.

Shrode said one differentiator that helps the proppant remain suspended for a long period of time is the angular geometry of the particles, which contrasts with many spherical microproppants on the market. Typical loadings range from 3,000 to 12,000 lbs per stage, or about 1% or less of the total sand volume.

"The product was initially created for production enhancement, but over time we found that it delivered many of the same benefits as acid," he said. "It reduced near-wellbore tortuosity, allowed pumps to reach full rate faster, shortened pump times, and helped mitigate negative parent-child communication effects." He added that the company's message evolved accordingly, shifting from production improvement to positioning the material as a safer, more effective alternative to acid treatments.

Nowadays, OFP is more confident about speaking about the production-enhancement potential its product offers. To bolster its own case, it is also showing engineers at industry conferences the results of ExxonMobil's recent success. As for its own success, OFP reports that



A scanning electron microscope image of a ceramic microproppant, the smallest particles of which have shown in testing to settle at a rate that is two orders of magnitude slower than that of 100-mesh sand. Source: URTeC 4203238/Zeeospheres Ceramics.

its product has delivered 24 to 56% increases in incremental production over offset wells. These figures are based on multiple analyses over a 3-year span and include wells in the Permian, the Denver-Julesburg, Powder River, and Williston basins.

OFP is now planning jobs with operators on trials that would offset sand with up to 10% microproppant, involving as much as 30,000 lbs per stage. The goal is to test how far conductivity can be enhanced by replacing a larger fraction of baseload sand.

"Hopefully people will see that they should run more tests and then be more likely to use it," Shrode said. He added that many of the operators OFP has recently engaged with are now focused on production enhancement, and that "it's all because of that paper" from ExxonMobil.

Small Proppant, Big Bucks

Montgomery of Fracdog recently collaborated on a microproppant project that used the Deeprop ceramic proppant made by Zeeospheres Ceramics. The work, presented in **URTeC 4203238**, suggests that microproppants can improve Permian well performance by about 15%, translating to millions of dollars in added revenue over the first 5 years of production.

Montgomery said microproppants address a fundamental challenge in shale: as much as two-thirds of the fracture area created during a pumping job is never effectively propped. He argues that microproppants mitigate this issue by a wide margin.

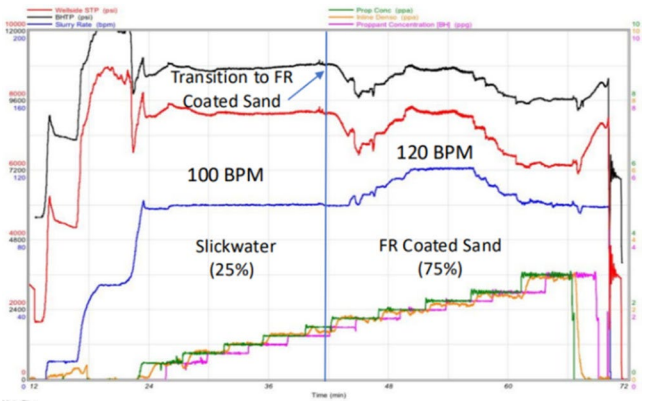
"The idea here is these lightweight proppants or microproppants are much better than sand because of their size, which means they can transport way out into the fractures, some that would be created but not propped. They are also able to penetrate into natural fractures that are 10 times smaller than what 100-mesh sand can enter," he said.

Some have questioned whether microproppants retain their value as formation pressure declines and closure stress increases. But Montgomery said an unpublished joint-industry project with the petroluem engineering department at the Texas A&M University suggests that the ceramic microproppant material leaves behind about 45 mD of conductivity, "which has a huge flow capacity compared with what the nano-Darcy-range shale rock has."

Despite the body of research showing that microproppants can deliver measurable gains, cost remains the largest obstacle. Montgomery noted that microproppants can add as much as 5% to the cost of bringing a new well online, a hurdle that some operators are unwilling to clear.

But he tries to counter this tendency by adding that microproppants can also save money by improving sand placement in the fracture network, which often prevents fracture stages from being lost to screenouts. Most vendors consistently highlight this benefit and say it has historically been their primary business driver. The hope now is that more operators will evaluate the production gains as well, which may be necessary for broader adoption.

Montgomery said the distinction comes down to mindset. Some companies are focused on



An example from the Midland Basin in the Permian shows a well treating the Wolfcamp A formation. The pumping job begins with liquid friction reducer (FR) and transitions to FR-coated sand, which lowered the treating pressure and allowed the operator to ramp up the pump rate by 20 bbl/min (BPM). Source: AquaSmart Global.

immediate savings through reduced screenouts and smoother pumping, while others, in his view, resemble ExxonMobil in taking a longer horizon and targeting sustained production improvement.

Coated Sand for Transport and Efficiency

Calder Hendrickson, CEO of AquaSmart, has spent more than a decade working on ways to use sand and polymers to improve lawn and garden products, agriculture, concrete, and, more recently, unconventional oil and gas. Early versions of the company's technology were even used to treat the baseball field at Yankee Stadium in New York City. But being based in west Texas meant the company found itself surrounded by the region's fast-growing fracturing sand sector, which has since become its core business.

The company has now used its technology, called PropCoater, to treat sand in more than 5,000 fracture stages across various US basins. The company also recently struck a commercial agreement with SNF, the world's largest maker of friction-reducer products), to offer a more-integrated service.

The coating equipment arrives to location on a trailer, ingests sand or other proppant types, applies a fine powder coating of friction reducer through a mixer, and then feeds the material into the blender before it is sent downhole.

"We can coat any sand, pretty much any size. We have coated ceramic, resin, and lightweight proppant," Hendrickson explained. "We can take a dry friction reducer, and in real time give the completion engineer the ability to optimize concentration and essentially build a custom coating."

The company claims the coating technique lowers the effective specific gravity of the sand, giving it "micro-buoyancy" which allows the sand to stay suspended in slickwater to enable better transport. This helps the sand navigate the complexity of the near-wellbore area and beyond to create the potential for larger propped and effective fracture geometries.

Paul Huckabee, another long-time completions expert, spent the past 4 decades refining fracturing practices for Shell and is now working as an advisor with AquaSmart. He said the benefits of the coating technology include improved stimulation distribution in multiple-cluster-stage completions, while reducing the overall volume of friction reduction used in each well, which provides a cost savings.

"We've also learned that, because of the transport characteristics, we can use higher proppant concentrations if it is felt there's some value in doing that, which reduces the cycle time of the pumping jobs and reduces the water costs too."

But just as with the microproppant providers, AquaSmart is also reporting notable production gains from the use of its technology. Some of its latest cases will be presented soon in a technical paper at the **2026 SPE Hydraulic Fracturing Technology Conference** in The Woodlands, Texas.

In one example, the company plans to highlight a Permian project involving three pads with three wells each. Only one pad used the friction-reducer-coated sand, and those wells produced 38% more oil after 600 days.

In another case study, this one involving two pads with four wells each, showed that wells

pumped with the coated sand achieved 23% uplift over the first 8 months of the wells' life—amounting to more than $8.8 million in additional revenue for the operator at an assumed oil price of $75/bbl.

It is difficult to imagine these results occurring without an improvement in fracture conductivity, but without an extensive diagnostics program, it remains challenging to collect firm data.

Acknowledging this gap, Huckabee said, "We clearly see better suspension and transport in the near-wellbore region, and we expect that to hold and translate into a more-effective far-field treatment. And in our production examples, we are seeing uplift in almost every case."

The paper will also show significant efficiencies, including increased injection rates by 10% or more while lowering wellhead treating pressures. The company believes this benefit promotes more uniform cluster efficiency and the potential to limit fracture-driven interactions. "This is especially important as longer lateral lengths are being drilled to maintain or increase stage lengths across the entire lateral length," said Huckabee. Translating these efficiencies into dollars, AquaSmart believes its case studies from the Permian showed it lowered stimulation costs by $250,000 to $325,000 per well.

"If we want to access Tier 2 and Tier 3 rock across North America, we have to figure out how to do this better and cheaper. For us, the message is that the technology is either cost-neutral or provides a savings—and it has a high potential for production uplift," said Hendrickson.

The claims of higher production from the proppant-technology developers are moving from the margins toward the center of the discussion, though it will take more time and likely more trials to see if the broader unconventional sector agrees and is willing to spend more money to produce more oil. **JPT**

FOR FURTHER READING

SPE 204135 Novel Learnings of Proppant Transport Behavior in Unconventional Hydraulic Fractures *by A. Singh, X. Liu, J. Wang, and P. Rijken, Chevron Corporation.*

URTeC 4203238 On the Use of Spherical Microproppants in Shale Fracturing *by C.T. Montgomery, Fracdog LLC; E. Siebrits, Consultant; and B. Strobel, Zeeospheres Ceramics LLC.*

URTeC 4264319 Development of a Novel, Patented Fracturing Technology Based on Low-Cost Petroleum Coke Light Weight Proppant From Lab-Scale Evaluation to Field Scale Pilots: Case Studies in the Midland and Delaware Basins *by R. Shirley, P.M. Spiecker, J.S. Brown, X. Jin, M.G. Kulkarni, C.-S. Kao, P.A. Gordon, T.J. Moffett, and G. Staus, ExxonMobil Technology and Engineering Company; T. Benish, ExxonMobil Upstream Integrated Solutions Company; and S. Kumar D, ExxonMobil Services & Technology Private Ltd.*

SPE 212341 Initial Observations From a Bakken Microproppant Field Trial *by T. Palisch and J. Giesbrecht, CARBO Ceramics; A.O. Lorwongngam and L. Kalfayan, Hess.*