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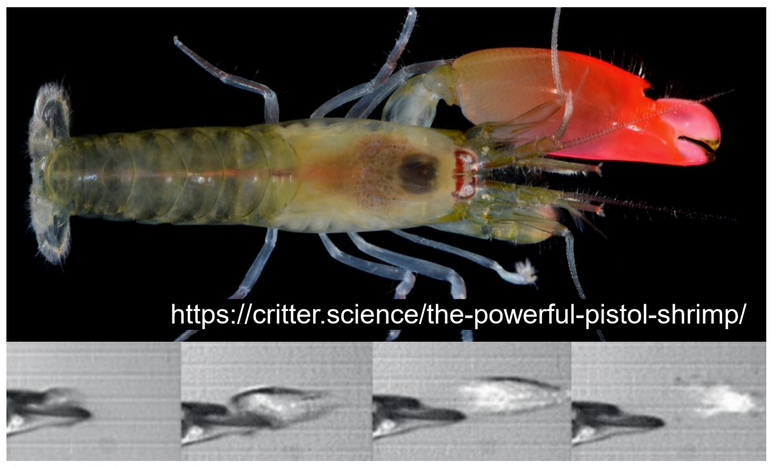
Bioinspired Snapping-Claw Apparatus to Study Flow-Accelerated Corrosion of Low-Carbon Steel

Francisco Godínez [1], Rodrigo Montoya [2], Marvin Montoya-Rangel [2]
1 Instituto de Ingeniería UNAM, 2 Facultad de Química UNAM

INTRODUCTION & AIM



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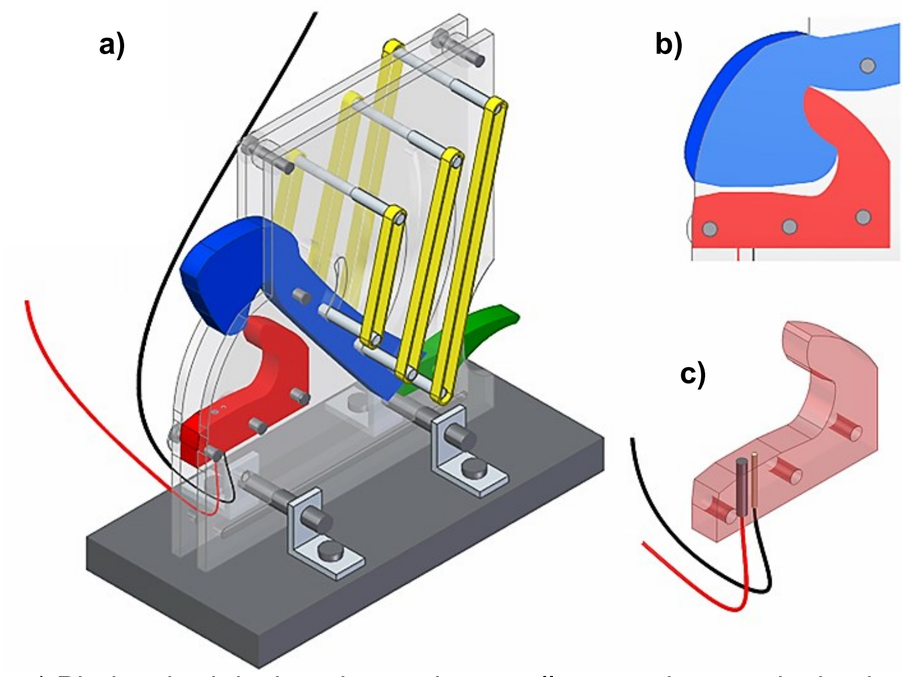
High speed jets

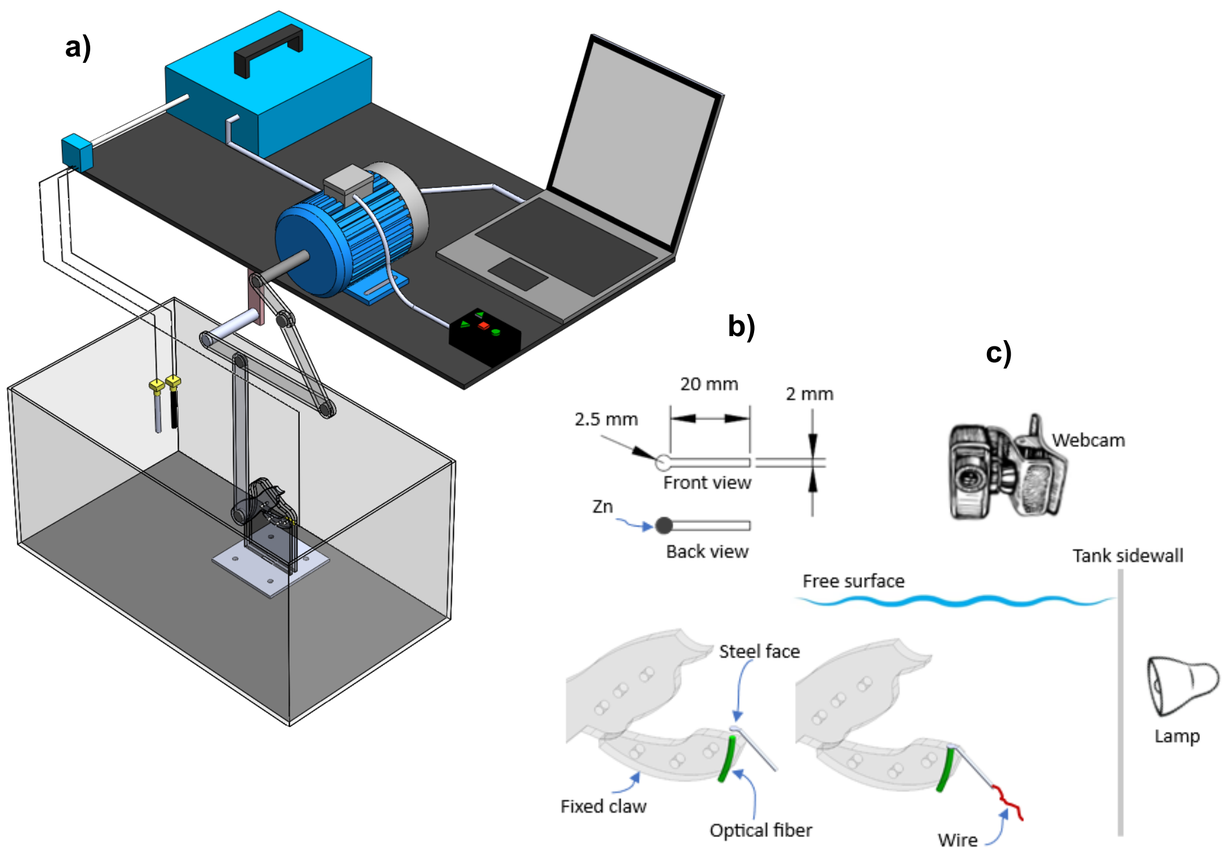
- Cavitation
- Shock waves
- High temperatures
- High pressures
- Photons
- OH radicals

APPLICATIONS?

METHOD

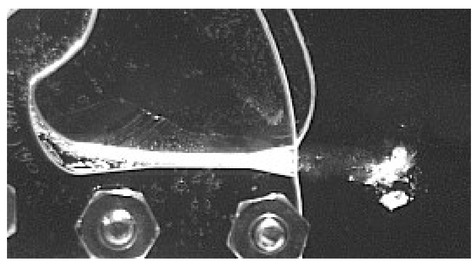


a) Bio-inspired device triggered manually to produce cavitating jets. b) Venturi tube formed by the closure of the mobile claw., c) electrochemical cell with a steel sample as working electrode.

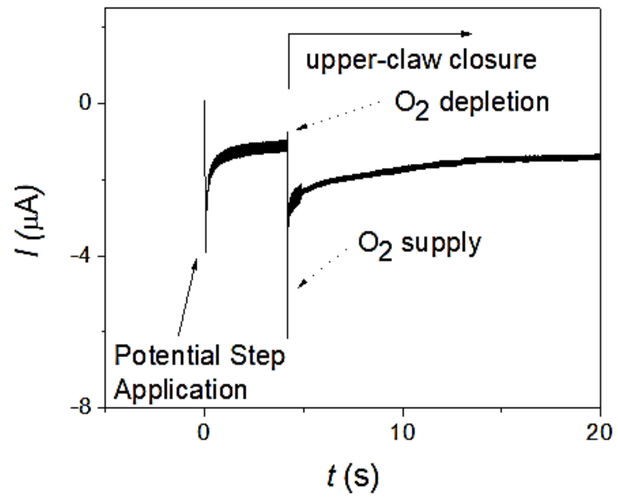


a) Automated apparatus to study accelerated corrosion. b) Steel samples with zinc coating, c) use of a webcam and a fiber optic coupled to a laser to observe pitting in the samples.

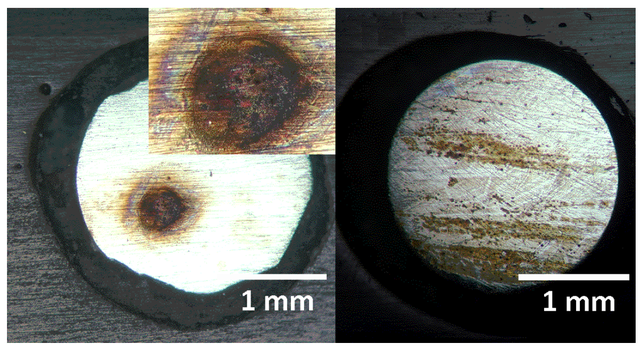
RESULTS & DISCUSSION



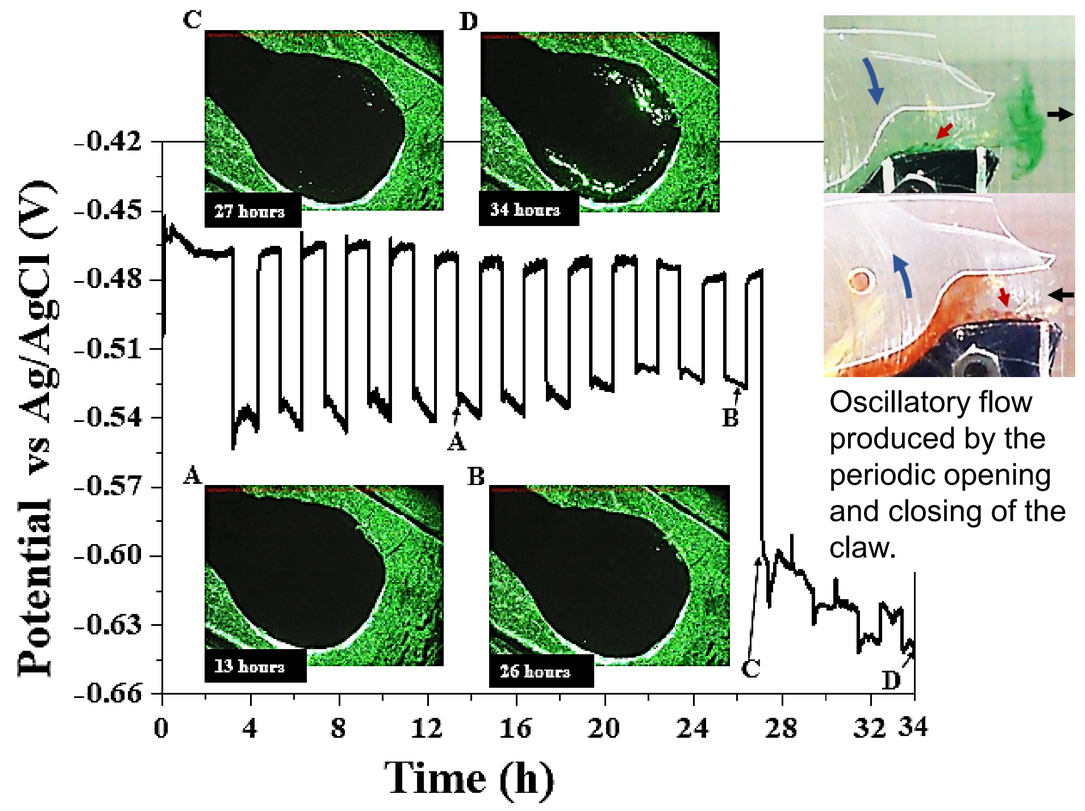
Cavitating flow captured with a high-speed camera.



Chronoamperometric curve of the carbon steel sample.



Corrosion and erosion of steel specimens caused by cavitating flow.



Oscillatory flow produced by the periodic opening and closing of the claw.

Optical and electrochemical pitting detection.

CONCLUSION

- The additional dissolved O2 provided during the closure of the upper claw is the primary mechanism responsible for the findings seen in the manually triggered device.
- The combination of very-thin carbon steel specimens with Zn coating, along with the use of electrochemical sensing and laser illumination, provides an effective corrosion sensor system for monitoring and detecting pit formation on steel surfaces.

FUTURE WORK / REFERENCES

Study of accelerated corrosion due to **cavitating flows** using an **automatic system** with a sudden closing claw.

1. Godínez, F. A., Mayén-Mondragón, R., Guzmán, J. E. V., Chávez, O., Gavaises, M., & Montoya, R. (2020). Bioinspired snapping-claw apparatus to study hydrodynamic cavitation effects on the corrosion of metallic samples. Review of Scientific Instruments, 91(6).
2. Godínez, F. A., Montoya-Rangel, M., & Montoya, R. (2024). Accelerated corrosion of low carbon steel by oscillatory acidic streams generated with a bio-inspired claw device. Plos one, 19(4), e0298266.