

CASE STUDY

United States of America

The Dow Chemical Company Noise and Vibration Analysis of Materials

Automotive, Environmental and Industrial

PULSE, Transducers, Calibrators

The Dow Chemical Company is a leading science and technology company that provides innovative chemical, plastic and agricultural products and services to many consumer markets. With annual sales of \$28 billion in 2002, Dow serves customers in more than 170 countries throughout the world.

Dow's Technical Research and Development Center at Midland, Michigan, develops products and solutions based on Dow's inherent strength in science and technology. There is a special focus on sound and vibration. A Brüel & Kjær PULSE™ system, transducers, and other products are widely used to test the characteristics of new materials.



History

The origins of The Dow Chemical company date back more than a century. Today, the company develops, and manufactures products for wide range of markets that are vital to human progress, including food, transportation, health and medicine, personal and home care, and building and construction.

With manufacturing and distribution facilities in North America, Europe, Latin America, Asia Pacific, Africa, The Middle East and Indian sub-continent, Dow employs some 50000 people globally.

U.S President George W. Bush recently honoured The Dow Chemical Company with the National Medal of Technology “for the vision to create great science and innovative technology in the chemical industry and the positive impact that commercialisation of this technology has had on society”.

Research & Development

Dow's Technical Research and Development facility is located at Midland, Michigan, some 100 miles (160 km) north-west of Detroit. The new building in the Larkin Center was opened in June 1998. It's the location of Dow Fabricated Product's commercial, R&D and application development staff of about 250 people.

Fig. 1
Dow's Technical Research and Development Center is located at Midland, Michigan. The new building, housing about 250 employees, was opened in 1998



The facility's laboratory is accredited to NAVLAB, ISO 9001, and has an ISO 17025 certificate.

Competitive Advantage

Fig. 2
Daniel R. Schroer is Senior Acoustics and NVH Engineer in Dow's laboratory at Midland



Daniel R. Schroer is a Senior Acoustics and NVH Engineer in Dow's Midland-based laboratory. He has a degree in mechanical engineering from Michigan Technological University and has worked at Dow for three years. Dan was previously an NVH engineer at Delphi.

Dan explains, "We are the fabricated products business unit of The Dow Chemical Company. Sound and vibration was a special area where we felt we could gain strong competitive advantage with our products. Value to the customer is most important, while maintaining high performance".

He continues, "Like all the personnel here in the lab, we are focused on R&D. I enjoy being involved in product development. The focus of the new business development department is to evolve new ideas for our markets, and customers – to look for new market opportunities. I enjoy working with state-of-the-art technology, and to see our ideas evolve into effective solutions".

Fig. 3
A Brüel & Kjær PULSE Material Testing system Type 7758 is used in Dow's laboratory to test the acoustical properties of materials



“I also have partial application development responsibility for QUASH™. This is a very unique closed-cell sound-absorbent foam product. It’s not a porous foam or fibrous and has a number of applications in the industrial and transportation markets, such as rail cars, trucks and buses”, says Dan.

He adds, “The automotive industry is a key market for Dow and much of the work we do in the lab is related to the transportation industry. Our materials are used to manufacture adhesives, sealants, body structure products, thermal and acoustic solutions”.

NVH Testing

Dan says, “Sound and vibration testing is principally made during the R&D stage of new products. All materials for sound or vibration reduction have a specification that has to be validated. We carry out a lot of testing for both our external customers and our internal customers within Dow. In addition to the automotive industry, we also develop and test materials for aerospace, telecommunications, building and construction, packaging and many other industrial markets”.

The laboratory’s temperature and humidity are accurately controlled to ensure consistent and reproducible test results. A Brüel&Kjær PULSE Material Testing system Type 7758 is extensively used to test the acoustical properties of materials. Dan says, “The sound absorption properties of materials are especially important and we not only make this type of test during R&D but also test samples from the production line, and of course, we make benchmark tests on our competitor’s products. The frequencies of interest are from 60 Hz to 6.4 kHz. We also use the facilities in the laboratory, including our Brüel & Kjær NVH equipment, for audit testing”.

Fig. 4
Dan Schroer has designed a built a special transmission loss test setup. The chamber is shown in the foreground



Together with Jean Philippe Deblander of Dow (he is the sound and vibration technical leader for Dow fabricated products globally), Dan has designed and built an advanced test setup for transmission loss tests. Completed in January, 2002, the details of it’s design and construction are confidential. He explains, “The transmission loss setup allows us to test small samples very fast. It’s excellent for comparison purposes and benchmark testing. We don’t have to pay an external

laboratory, and we can keep the results secret. We use pink noise from the PULSE generator module and typically generate 110 dB in the chamber”.

A Complex Modulus Apparatus (Oberst bar method) is used to test the damping characteristics of materials. The material sample is excited by a transducer that is driven by the PULSE generator. The response of the sample is measured and analysed by another transducer connected to PULSE.

The laboratory is also equipped with a small Brüel&Kjær vibration table. Dan says, “We use this to measure foam modulus and loss factor data. It’s very useful, especially

for benchmark testing. It uses a force transducer, shaker and accelerometer. Again, we use the generator module in PULSE and excite the shaker with a swept sine wave from 30Hz to 3kHz. Power Amplifier Type 2706 is used to drive the shaker, and also the material testing system”.

“The transducers are calibrated before every test. We use a Brüel&Kjær Sound Level Calibrator Type 4231 for the microphones. Like the calibration process within PULSE, it’s part of the routine used with all our Brüel&Kjær equipment.”

PULSE

Fig. 5
A 4-channel PULSE system was purchased four years ago. The Complex Modulus Apparatus is used to test the vibration damping characteristics of materials



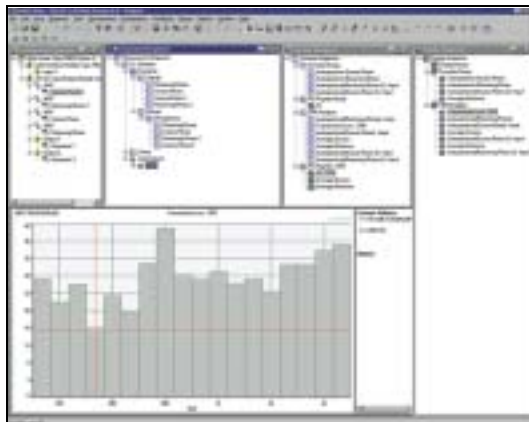
Dan explains, “All our sound and vibration related products are from Brüel&Kjær”.

He adds, “The PULSE system is widely used every day and has a 4-channel front-end module, and a built in generator that is used to drive the material testing impedance tube, the complex modulus apparatus and our transmission-loss test setup. We use all four channels for transmission loss measurements and two channels when using the material testing system”.

“With PULSE I know what is going on. It’s easy to use and easy to set up, and simple to customise. It’s also accurate, and I have confidence that the test data is correct. With other systems I have used, compared to PULSE, they were difficult to use and there were too many possibilities of making mistakes. I particularly like the facility to use TEDS (Transducer Electronic Data Sheet) transducers as it’s quick and avoid errors during the test setup”.

PULSE runs under Windows® 2000.

Fig. 6
The PULSE CPB analyzer is used for transmission loss measurements



Dan says, “To get familiar with PULSE, I went on a Brüel&Kjær training course, which was excellent. There is a moderate learning curve but once you understand how the PULSE ‘organisers’ work, then it’s easy because it’s logical. One of our students trained himself in basic PULSE operation just by reading the on-line help. Now I can make customised test templates for the vibration table, complex modulus apparatus and transmission loss setup”.

“With our own test facilities, I can make measurements very fast, as soon as they are needed and it’s cost effective.”

Data and Reporting

The test data is saved on the PC hard disk. It’s also saved on a network server so that the test data is available to Dow facilities throughout the world. For example, the exchange and comparison of data is made with Dow in Germany who also has Brüel & Kjær equipment. Dan says, “We are interested in the PULSE Data Manager for the archiving, retrieval and comparison of test data”.

Using the report generation facility in PULSE, the test data is exported to Microsoft® Excel to create a spreadsheet. The Excel files are also placed on the network server.

Printed reports are then produced and distributed.

Benefits

Dan concludes, “PULSE has proved to be very reliable. The back up service and support from Brüel & Kjær's local office in Livonia is excellent”.

“Fast, accurate and efficient NVH testing greatly helps us to develop cost-effective customer solutions.”

Key Facts

- The Dow Chemical Company is a leading science and technology company that provides innovative chemical, plastic and agricultural products and services to many consumer markets
- Dow serves customers in more than 170 countries throughout the world.
- Dow’s Technical Research and Development Center develops new cost-effective, high performance products and solutions
- The facility’s laboratory is accredited to NAVLAB, ISO 9001, and has an ISO 17025 certificate.
- There is a special focus on sound and vibration
- A Brüel & Kjær PULSE™ system, transducers, and other products are widely used to test the characteristics of new materials
- The automotive industry is a key market for Dow
- A Brüel & Kjær PULSE Material Testing system Type 7758 is extensively used to test the acoustical properties of materials
- “All our sound and vibration related products are from Brüel & Kjær”
- “With PULSE I know what is going on. It's easy to use and easy to set up, and simple to customise. It's also accurate, and I have confidence that the test data is correct”
- “I particularly like the facility to use TEDS transducers”
- “Fast, accurate and efficient NVH testing greatly helps us to develop cost-effective customer solutions”