２Ｄ２４

How can a chemical company accelerate product innovation in the dynamic industry change?

○Masayuki Hirosue (BASF SE), Hideki Hayashida (Tokyo University of Agriculture and Technology)
Masayuki.hirosue@basf.com

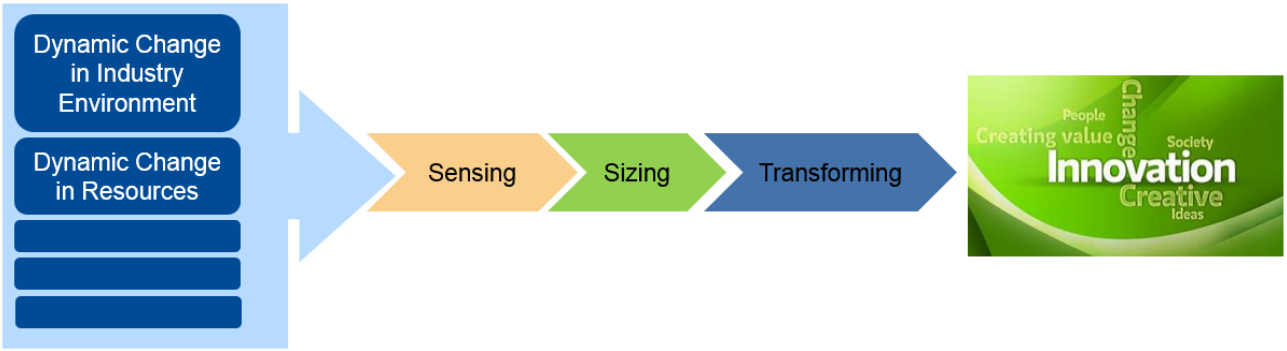
1. Introduction

Like e-mobility and autonomous driving, the automotive industry has faced dynamic environmental changes over the last couple of years. Due to the recent dynamic shift, the benchmarking and positioning approach has suffered from the limitation of identifying future innovation trends. BASF has applied the dynamic capability theory to visualize the industrial trend for developing new coolants for e-mobility. As the result, BASF has developed a commercially available new coolant showing excellent corrosion protection as well as a safe and reliable performance. In this conference, the authors are going to evaluate the transition from theory to product development.

2. Empirical study

2.1. Background

German-based BASF is one of the largest chemical companies with more than 150 years history. BASF have coolants in their product range under the brand name GLYSANTIN®. These products reliably protect engines all year round from corrosion, overheating and frost, even under extreme climatic conditions (1). BASF patented GLYSANTIN® in 1929, and the proprietary products have most OEM approvals from the large motor manufacturers (2). Positioning and benchmarking strategic approach from the Porter's theory helped GLYSANTIN® to develop its brand position in the industry. Furthermore, GLYSANTIN® G64® was introduced to the industry with best harmony to downsized conventional engine in 2015(3). This harmony was identified by benchmarking the technical performance of the coolant in market (Scheme 1)



Scheme 1, Dynamic Capability Theory

2.2. Dynamic Change in Industry

Automotive industry has recently faced to the dynamic environmental change. Electrification and autonomous driving technology, for example, have become more popular over the last couple of years. This new trend requires new materials and new solution to the car, which are not required for conventional car engines. Benchmarking and positing strategic approach therefore faced to the limitation. As an example, battery car does not contain the engine for the power generation. Engine generates a heat on the other hand battery can be operated the room temperature. It means that materials like metal and plastics to be used in the power train have totally different between engine car and battery electric vehicles. Additionally, coolant was required for maintaining the thermal management of the engine related parts in the conventional engine car. Coolant in engine car has reached to above 100℃ during the driving, while coolant in battery car does not reach to over 60℃, due to the different technology to produce energy source of the car.

This dynamic environmental change in the coolant industry demanded the coolant to have new performance criteria. Low conductivity of the coolant to ensure the safety of battery would be one of the newly established criteria. For instance, electronic shortage may be occurred when high conductivity liquid access to the high voltage energy source. It would be the potential emerging risk for the e-car, which are not experienced in engine car.

2.3. Dynamic Capability: Sensing & Sizing

Sensing is an important phase to re-define the value curve with valuable criteria. Re-positioning and benchmarking help to “feel and visualize” the innovation target within the organization.

Thermal management in electronic vehicle to maintain the optimal operation temperature of the battery is mandatory to have the longer driving distance. It is a fact that the coolant in the thermal management system in a hybrid car and plug in hybrid car contributes to keeping the optimal temperature for the battery.

However, conventional engine coolants, which are based on water-glycol chemistry, would have a risk for the electro-shortage of the battery with fire, especially when the coolant has access to the battery from the thermal management system during emergency.

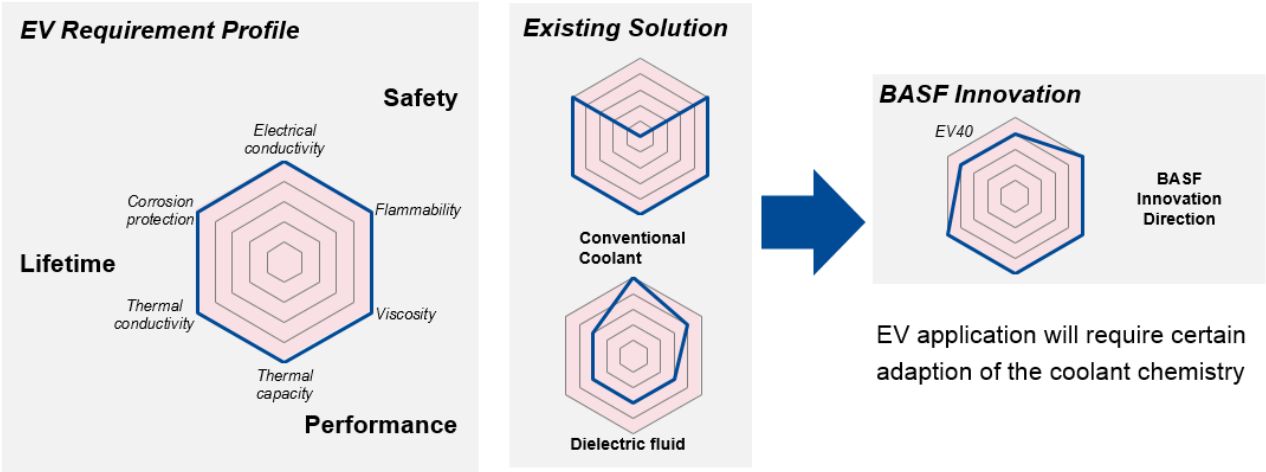


Figure 1. Performance value curve of the coolant

As written in right part of figure 1, innovation target was designed within the performance value curve. By visualizing the targets, team members had the same direction and it made easy to maximize the efficiency of internal resources. Several scientific publications and patents have already indicated the advantage of low conductivity water-glycol based coolant, but it was not regularly applied to the car due to the poor corrosion protection performance (4-6).With identifying the new expectation from industry, as an innovation strategy, BASF has decided to develop a low conductivity coolant with good corrosion protection for the emerging e-car application.

All members have same understanding to the project, BASF therefore has developed new product shorter project period than originally planned. New product has frost protection with equivalent to the conventional engine coolant. pH is neutral to slightly base condition with reserve alkalinity, it enhances the corrosion protection to metals with long service period like conventional long-life coolant.

2.4. Dynamic Capability: Transforming

Redefiing the internal resources for the dynamic industry environmental change is the theory of the dynamic capability. Including partner sites, BASF have globally 10 facilities to produce GLYSANTIN®. Ludwigshafen, as HQs of BASF, have developed the know-how of new product and BASF have systematic approach to transfer know-how from HQs to group companies.

This systematic approach enables BASF to produce the same quality product within short period at all BASF's remote locations. Furthermore, all GLYSANTIN® facilities have the IATF16949 certification.

Moreover, as an adaption to the external environmental dynamic change and international standard, BASF have actively supported the standardization activity of new coolant under ASTM (American Society for Testing and Materials) framework.

3. Discussion and conclusion

It is indicated as an empirical research that BASF's new product innovation under GLYSANTIN® brand is the good example of the pragmatic implementation of dynamic capability to the automotive fluid industry in the Germany based company. Implementation of a new product into the industry in general will be further monitored by the authors.

Reference

[1] BASF annual report 2019
[2] Glysantin home page : https://www.glysantin.de/en
[3] BASF Press Release : 20150618 Keeping downsized engines cool
https://www.basf.com/global/en/media/news-releases/2015/06/p-15-259.html
[4] Harald Dietl, Uwe Nitzschke, Gerhard Weiss: Antifreeze concentrate with corrosion protection and aqueous coolant composition produced therefrom, US9080093B2
[5] Harald Dietl, Roger Sieg : Coolant for cooling systems in electric vehicles having fuel cells and/or batteries containing azole derivatives and additional corrosion protectants, WO2018095759A1
[6] Bernd Wenderoth, Ladislaus Meszaros, Stefan Dambach, Uwe Fidorra, Marco Bergemann: Cooling agents for cooling systems in fuel cell drives,WO2002055630A1