



Virtueller Biofouling-Workshop 24.11.2020  
- Aktuelle Branchenentwicklung -

**„Testmethoden zur Erprobung innovativer  
Antifouling-Systeme “**

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**DR. BRILL + PARTNER**  
INSTITUT FÜR ANTIFOULING UND BIOKORROSION

**Norderney**



seit 2013

**Strandstation**

seit 2001

**Hafenstation**

Quelle: mce-verlag.de

## Mariner Bewuchs auf technischen Oberflächen um Norderney



## Sportboote

## KüMos

## Hochseeschiffe

**Worst  
Case**



**“normal”**



**Test-  
flächen**



## Schäden durch Bewuchs

Technische Probleme durch Bewuchs: - Manövrierunfähigkeit



## Schäden durch Bewuchs

Offshore-Piles



Ozeanographische Messgeräte

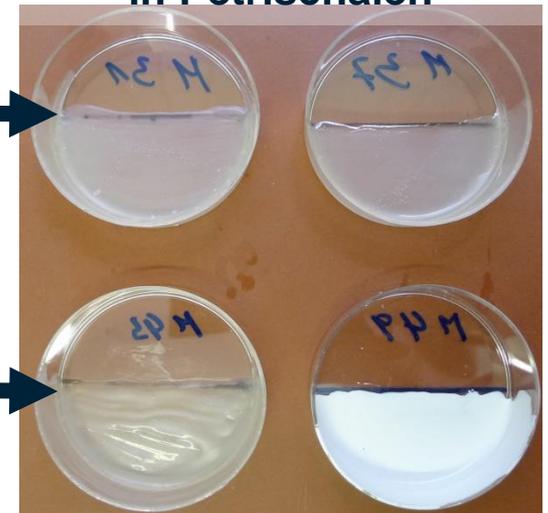


## Methode Labortest: Seepockenlarventest

**Käschern, Identifizieren und Auszählen von Seepockenlarven**

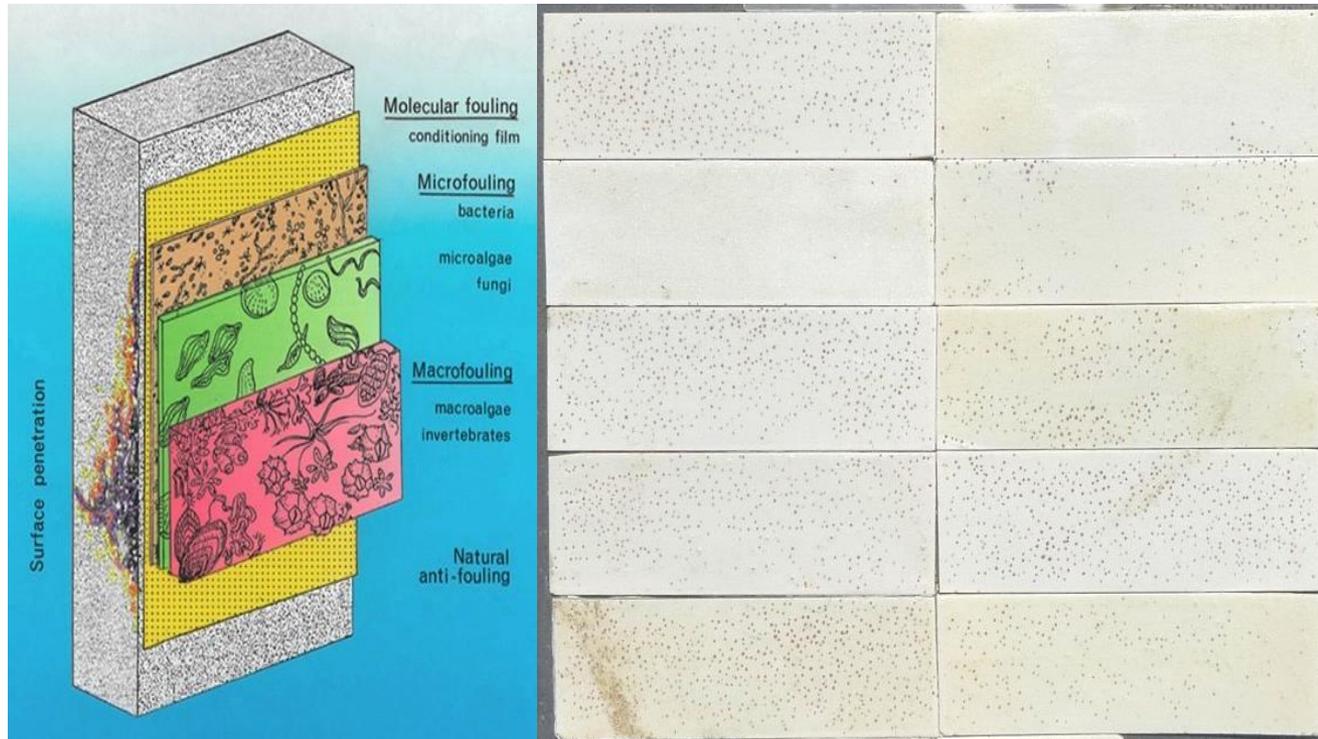


**Ansiedlungsverhalten  
in Petrischalen**



**Alternativ: Kultur von Seepockenlarven im Labor**

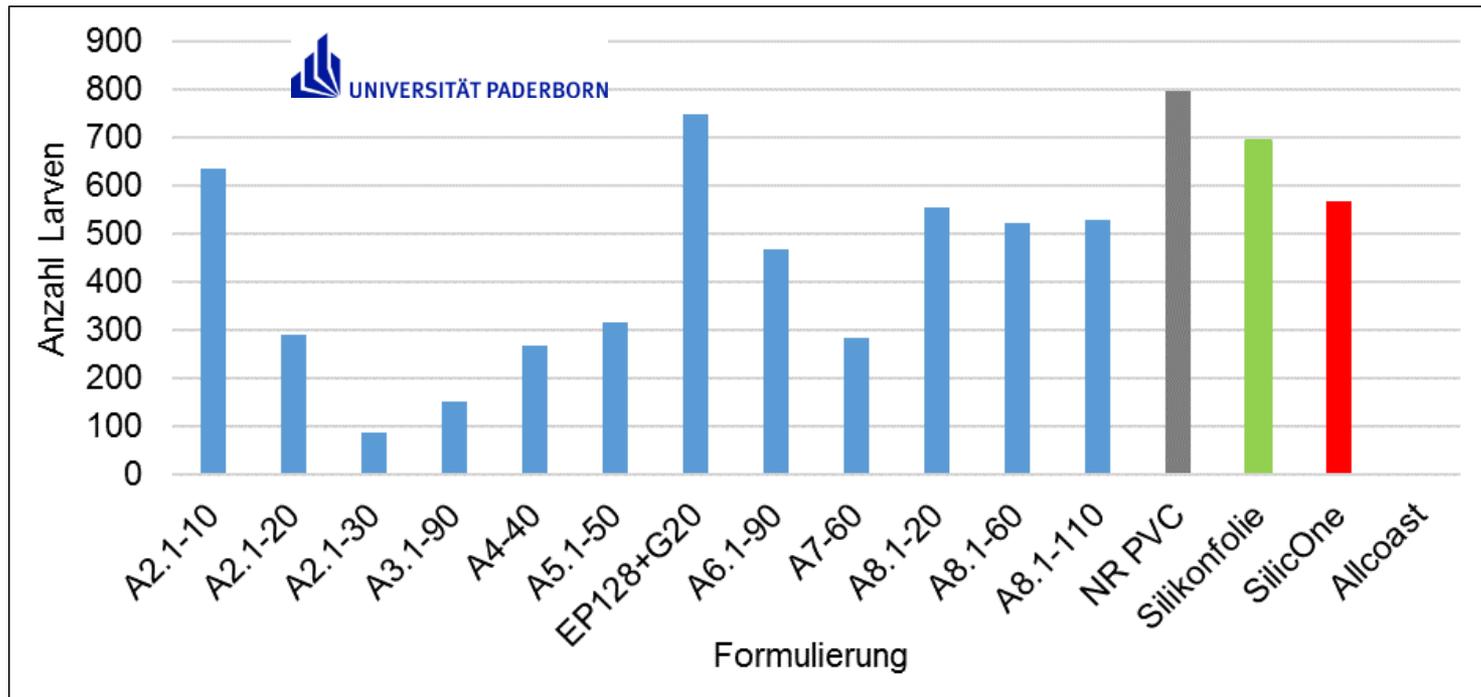
## Simulierter Feldtest: Seepockenschnelltest



[Quelle: Natural  
Environmental Research  
Council (NERC)]

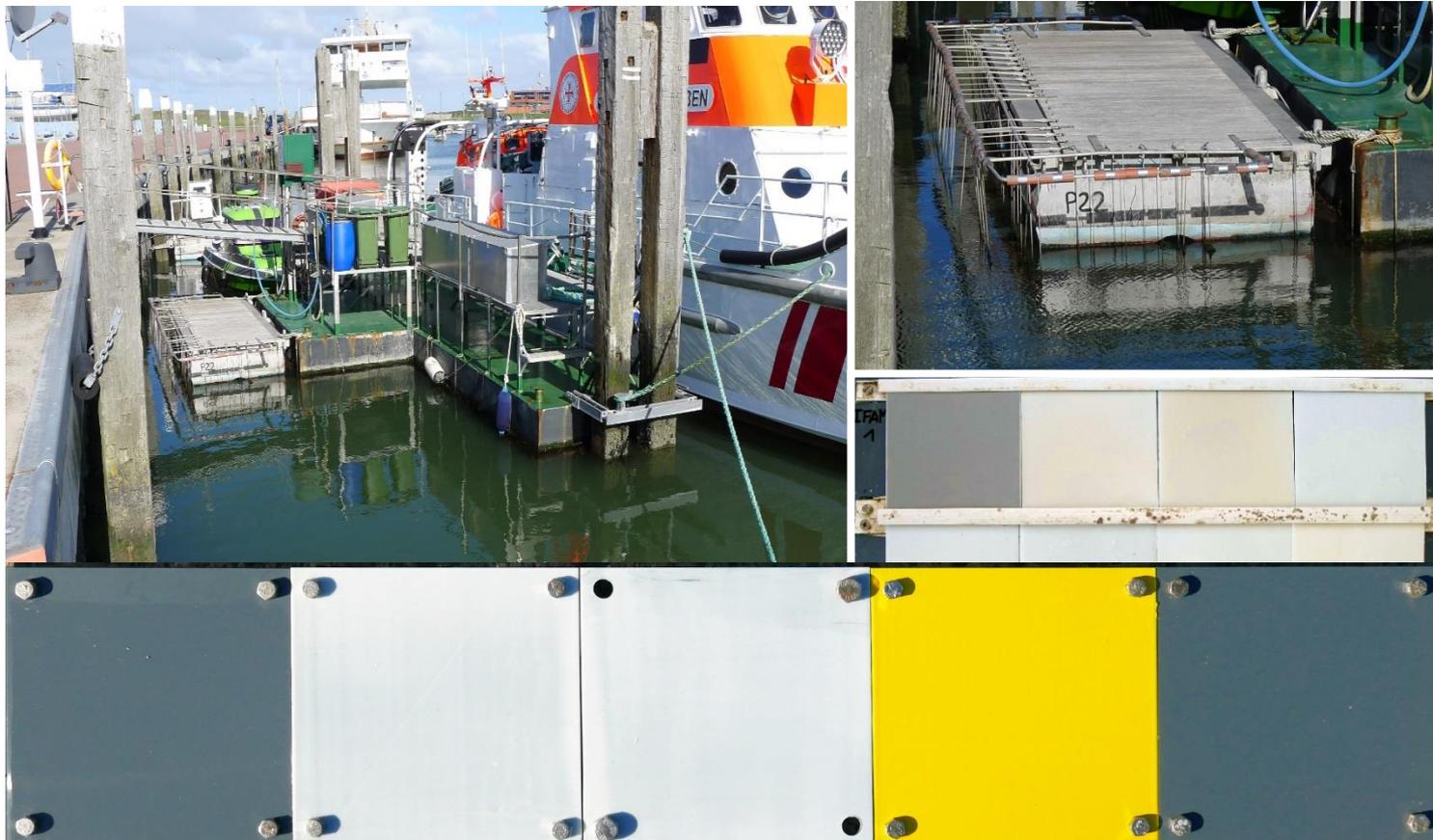
# Simulierter Feldtest: Seepockenschnelltest

## Ergebnisdarstellung Seepockenschnelltest



# Methode Simulierter statischer Feldtest für 6 Monate + Hafenstation

Testplatten ständig vertaucht am Ponton

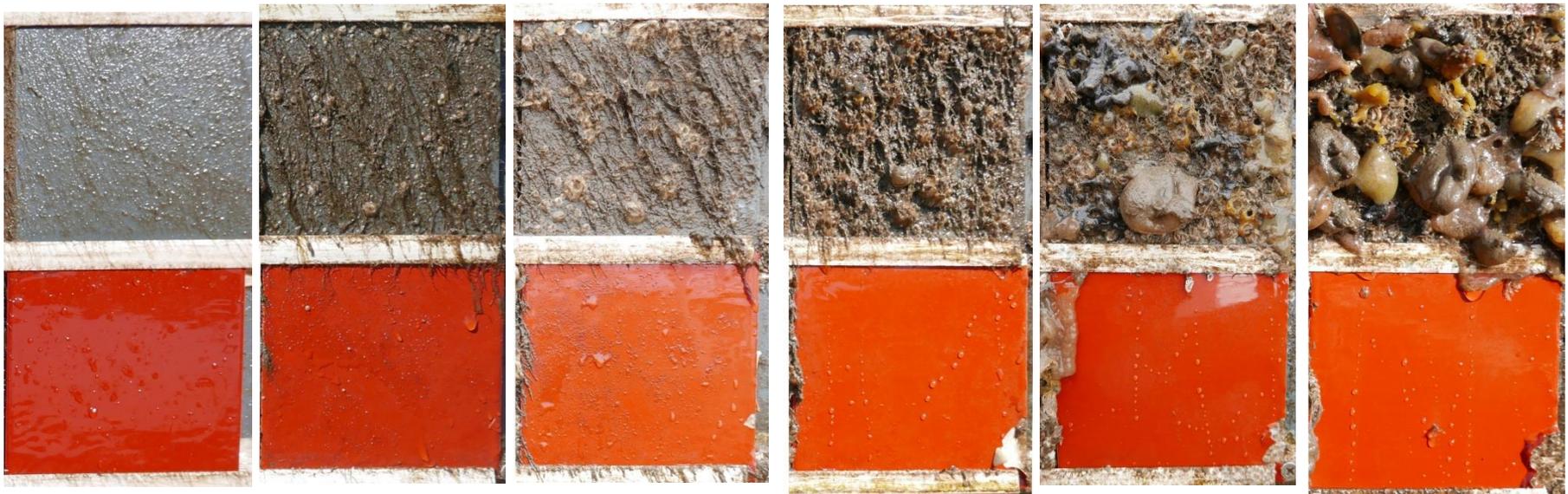


Statischer Plattentest

## Simulierter statischer Feldtest für 6 Monate +

### Bewuchssukzession auf Referenzplatten 2018

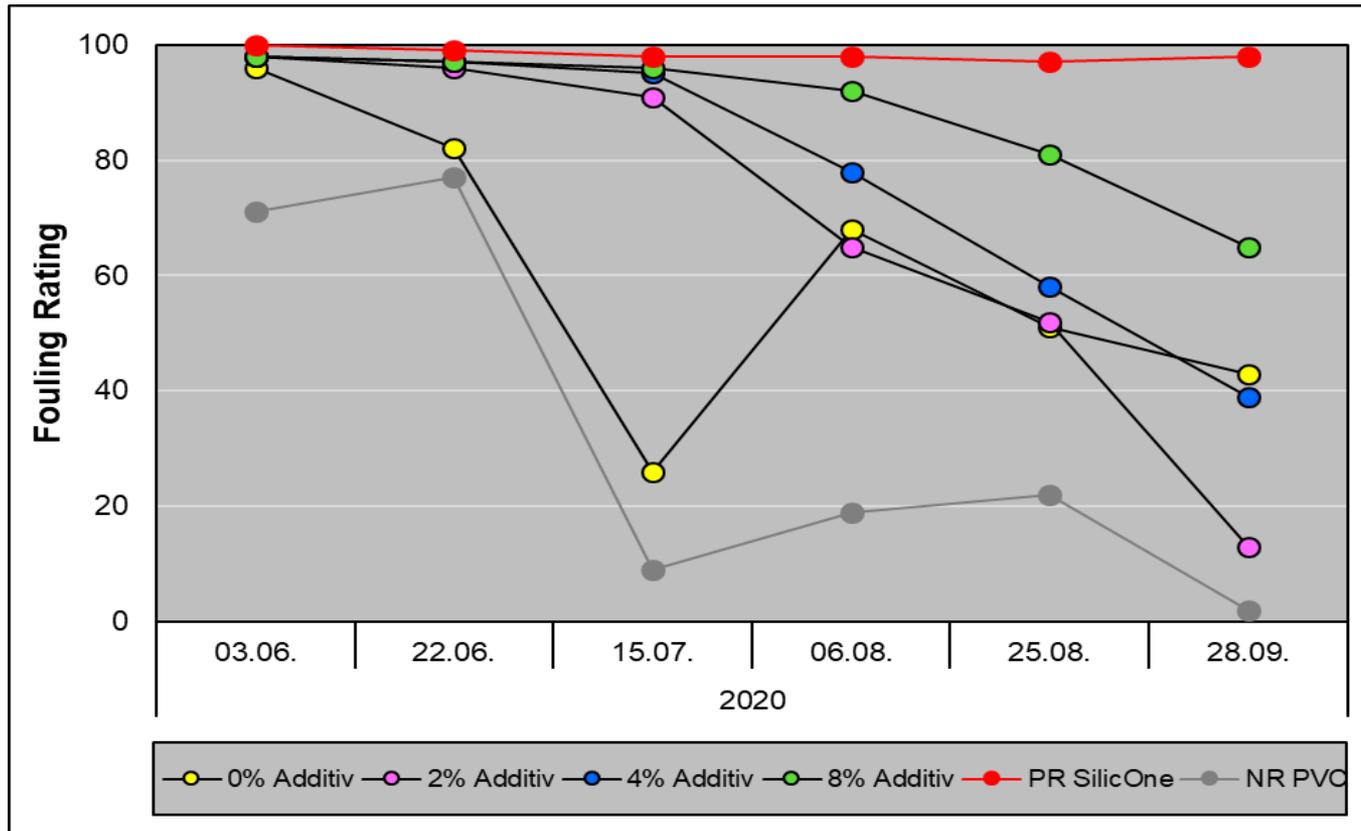
Negativreferenz PVC



Positivreferenz Hempel`s SilicOne

## Simulierter statischer Feldtest für 6 Monate

Ergebnisdarstellung Fouling Rating nach ASTM 6990-20



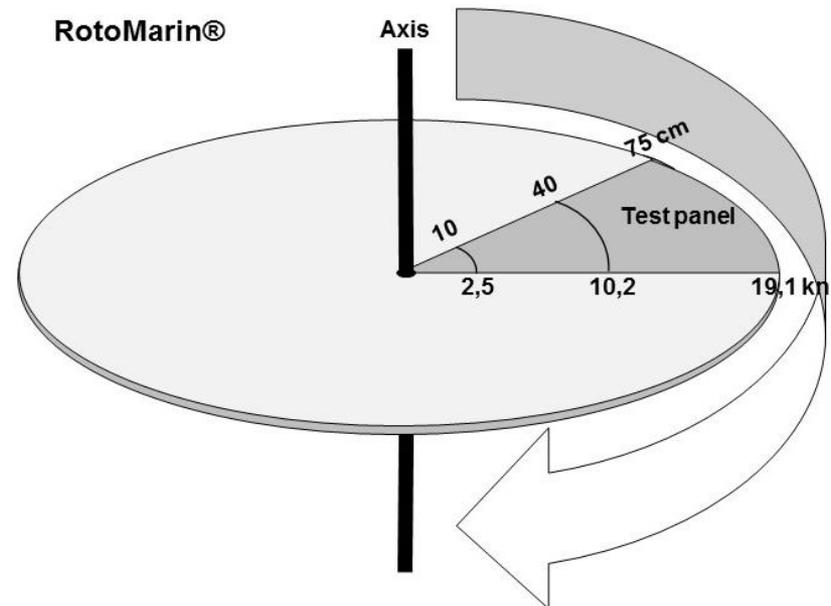
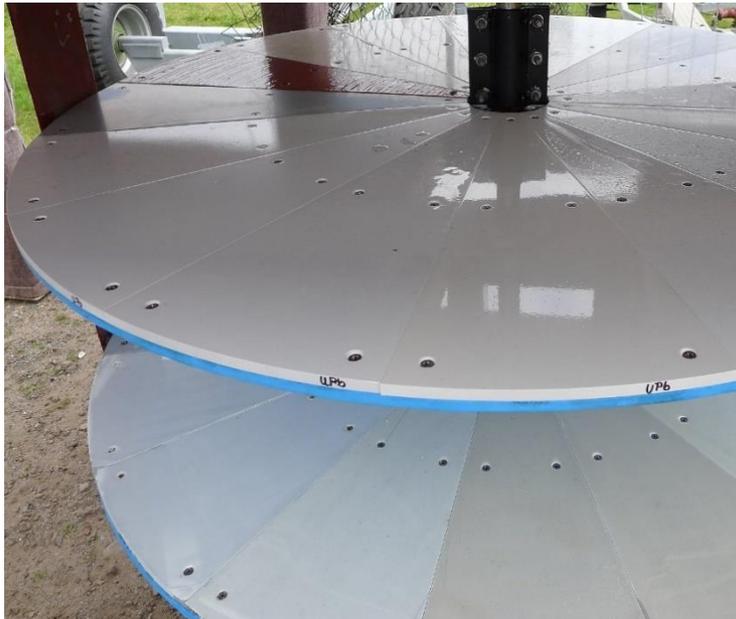
## Simulierter statischer Feldtest für 18 Monate +



**13. Inspektion 2. Oktober 2020 nach 534 Tagen**

# Methode Simulierter dynamischer Feldtest für 6 Monate

RotoMarin<sup>®</sup>



# Simulierter dynamischer Feldtest für 6 Monate

## RotoMarin<sup>®</sup>, Institut für Antifouling & Biokorrosion





## RotoMarin®



## nach 3 Monaten

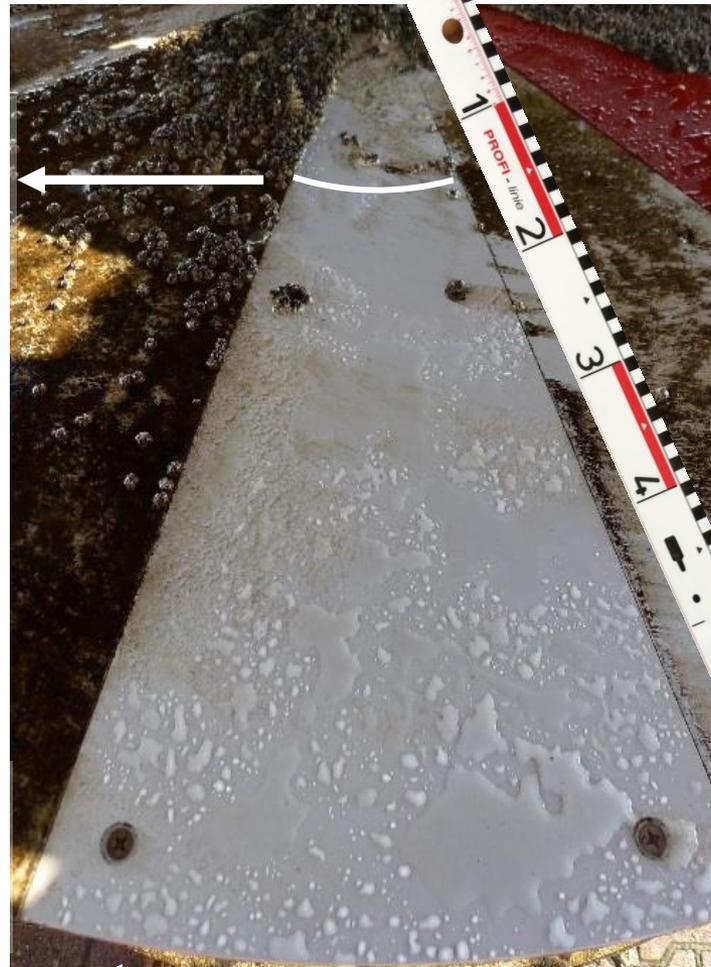


RotoMarin® – 10. Juli – 1. Oktober

## Brills RotoMarin®

minimale  
Geschwindig-  
keit: 1.2 m/s  
= 2.4 kn

6.3 m/s  
=  
12.2 kn



Auf diese Weise kann die kritische Geschwindigkeit ermittelt werden, die für eine Selbstreinigung der jeweiligen Beschichtung notwendig ist.

Zusätzlich:  
Auswertung nach  
ASTM 6990-20 für  
innen und außen



38 FOUL-RELEASE COATINGS



## PUTTING ANTI-FOULING COATINGS TO THE TEST

Realistic simulation provides valuable information for paint manufacturers. By Bernd Daehne, Dr Brill + Partner GmbH Institut für Antifouling und Biokorrosion, Norderey, Burkard T. Watermann, LimnoMar, Hamburg, and Constanze Fölz, LimnoMar, Norderey.

Self-cleaning coatings offer ship owners critical protection against fouling and the issues this can cause. However, the mandatory tests for these coatings do not represent real-life conditions for the intended use. A novel circular test bench, that was developed in the R&D project "FoulProtect", funded by the Federal Ministry for Economic Affairs and Energy (FKZ: 03SX370E), uses a dynamic method to obtain accurate information. For example, on the minimum speeds required to activate self-cleaning effects and prevent fouling.

Fouling is sufficiently known as a great problem for ships causing a decrease of service speed and manoeuvrability and an increase in fuel consumption and bio-corrosion (Woods Hole Oceanographic Institute 1952). On these grounds the need for an effective anti-fouling coating for ships in marine waters is undisputed. But the market for anti-fouling coatings has been evolving for many years as a result of emerging legal restrictions. These include the IMO International Convention on the Control of Harmful Anti-fouling Systems on Ships 2001, the EU Regulation No. 528/2012 of the European Parliament and of the Council of 23 May 2012, and national regulations such as in Scandinavia. Biocidal anti-fouling products are banned in all freshwa-

ter areas of Denmark, Sweden and Finland [1]. In Germany, biocidal products for leisure boats and professional shipping are banned on the Lake, Rostocker See and Schwansee [2].

**DYNAMIC TESTING TO SIMULATE REAL-LIFE CONDITIONS**

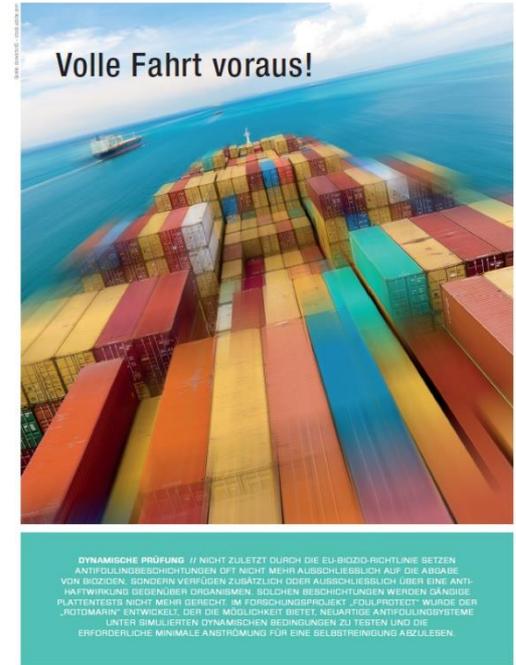
There has been a steady improvement in eroding and self-polishing biocidal paints that meet the requirements of national legislation. They can also be designed according to the ship's profile taking into account the activity level, service speed and lay-off periods. For these coatings, dynamic tests are more suitable for evaluating their performance as the release of biocides, or the leaching rate is dependent on the water flow around the hull. For non-biocidal coatings such as foul-release types, static simulated field tests are not state-of-the-art. Exclusively dynamic exposure reveals the performance of these coatings, which must show a significant level of self-cleaning at a certain service speed as indicated by the manufacturer. This is also aggravated by the fact that the service speed of the world fleet has decreased in the last years caused by the economic crisis since 2007 and high bunker rates. Now it is even more important for ship owners and paint manufacturers to know at what speed a certain anti-fouling formula-

EUROPEAN COATINGS JOURNAL 03 - 2018

18th ICMCF 2018 in Melbourne  
FL, USA

Europ. Coat. J. 03/2018: 38-42.

20 SCHIFFSFARBEN // PRÜFTECHNIK



FARB UND LACK // 08 2018

Farbe & Lack 08/2018: 20-25.

Volle Fahrt voraus!

DYNAMISCHE PRÜFUNG // NICHT ZULETZT DURCH DIE EU-BIOZID-RICHTLINIE SETZEN ANTIPOULINGBESCHRÄNKUNGEN OFT NICHT MEHR ABSCHLIESSELICH AUF DIE ABGABE VON BIOZIDEN, SONDERN VERFÜHREN ZUSÄTZLICH ODER AUSSCHLIEßLICH ÜBER EINE ANTI-FOULWIRKUNG BEI BESTIMMTER DYNAMISCHER BEWEGUNG ZU WERDEN. GRÜNDE: PLATTENTESTS NICHT MEHR GERECHT. IM FORSCHUNGSPROJEKT „FOULPROTECT“ WURDE DER „ROTO-MARIN“ ENTWICKELT, DER DIE MÖGLICHKEIT BIETET, NEUARTIGE ANTIPOULINGSYSTEME UNTER SIMULIERTEN DYNAMISCHEN BEDINGUNGEN ZU TESTEN UND DIE ERFORDERLICHE MINIMALE ANSTROMUNG FÜR EINE SELBSTREINIGUNG ABZULESEN.

## Methode Feldtests – Testplatten auf Küstenschiffen



**IFAM AP5**

**IFAM Q12 Riblet**

**Momentive**

**Uni PB Epoxy-  
PDMS-5wt%-j**



## Feldtests – Testflächen auf Küstenschiffen



FRISIA VII – 2. Mai 2017



FRISIA VII – 2. Mai 2017 – nach HDW Waschen (300 bar)

# Projekt BasaltFaserFlock

Gefördert durch:



aufgrund eines Beschlusses  
des Deutschen Bundestages



Supported by:



on the basis of a decision  
by the German Bundestag

## Basalt Fiber Flock as a novel, environmentally friendly antifoulant

Jörg ZSCHÄTZSCH (1), Bernd DAEHNE (2), Marius GÜNTHER (3),  
Steffen DIETSCH (4), Klaus HEINEMANN (5), Torsten BLUM (1), Torsten KUNZ (3)



**Fouling and its prevention**  
Marine growth is fascinating in the natural environment (left), but very undesirable on technical underwater surfaces such as ship hulls or piles (right). The most common method to prevent fouling is by using biocidal antifouling coatings. But because of their harmful characteristics to the environment more and more biocides become banned by the IMO, EU, and national legislations. This led to an increase of research on biocide-free solutions. Since 2016 the German Ministry for Economic Affairs and Energy is funding a R&D project on Basalt Fiber Flock as an environmentally friendly antifouling solution.

Natural fouling community

Ship's hull

Pile

**Basalt as a solution?**

Two findings have been the reason for the investigation on Basalt Fiber Flock as a new antifouling solution:

- Antibacterial properties were discovered in selected basalt deposits (Pfuch et al. 2018).
- Synthetic flock fiber coatings are well known for their efficacy against barnacle settlement (Watermann et al. 2003)

**Basalt rock**

- Natural source material
- Possible antifouling composition

natural deposit of basalt rock

quarry

basalt rock

**Basalt fiber**

- Melting rock powder at 1400 (± 50) °C / 2550 (± 120) °F
- Extruding filaments
- Bundle filaments up to a roving
- Applying specific sizing agent (sizing agent = chemical coating for further processing)

Basalt roving: SiO<sub>2</sub> 47.55% MgO up to 15%, Al<sub>2</sub>O<sub>3</sub> 14.19% Fe<sub>2</sub>O<sub>3</sub> 5.13%, CaO 5.72% others about 17%

molten basalt

**Electrostatic flocking**

- Charging flock fibers
- Accelerating flock fibers in an electrical field
- Fixing fibers vertical in adhesives

charging

dosages

acceleration and orientation

flock fibers

fixing

adhesive substrate

**Chemical finishing of fibers**

- Removing sizing agent
- Applying of flock preparation

unprepared flock fiber

prepared flock fiber

**Preparation of adhesive bonding**

- Pretreatment adhesive material (primer, sanding)
- Choosing suitable adhesives

**Development of a cutting system**

- Automatic feeding of the roving
- Cutting in 0.5 ... 1.0 mm (0.02 ... 0.04 in) staple fibers

basalt staple fibers

cutting system

**Progress report**

The basalt fibers are modified by the project partners in three different ways: Pretreatment, fiber length and flock density.

3D-SCAN Flock

They are tested and compared at the Institute for Antifouling & Biocorrosion of Dr. Brill & Partners on the North Sea island Norderney using the following four methods:

- Rapid test on barnacle settlement
- Statistical immersion tests
- Dynamic tests at the RotoMarin®
- Dynamic tests by patches at the RoRo-vessel Störtebeker

**Rapid test on barnacle settlement**

All Flock systems achieved productive results in the rapid test on barnacle settlement. Three test systems (32, 37, 38) had no barnacle seeds at all, in comparison to 720 barnacles on the untreated PVC at the same time.

Samples of the rapid barnacle test

Evaluation of the rapid barnacle test

**Statistical immersion tests**

The first statistical immersion test was conducted in the harbour of Cuxhaven in 2016. Despite a very high barnacle fouling pressure some test panels prevented the settlement of barnacles and other macrofauna organisms almost completely.

Sample 1 - Natur

Sample 2 - FF 93

Fouling Ratings of the statistical immersion test

The undamaged flock systems (green) reached Fouling Ratings up to 93 (Sample 6) at the end of the season, which was similar to synthetic fiber coatings (red) and significant better than the untreated PVC ones (grey).

**Dynamical testing at the RotoMarin**

Dynamical plates at the test bench RotoMarin® and patches on the RoRo-vessel Störtebeker, operating in the Wadden Sea, have been assembled in May 2016 and will be evaluated at the end of September 2016.

Samples of the RotoMarin® test

References

- Hahn, A., M. Ullrich, M. Hamm, S. Vossne & U. Günther, private s.v.: Vernehmung von Basalt zur Reduzierung von Fouling und/oder als antiseptisches Material, Beschichtung für eine Zuchttaube und Verfahren zur Herstellung einer Beschichtung DE 10 2016 223 453 A1, 2016, 06.09.
- Watermann, U. J., S. Ullrich, M. Watermann, M. Ullrich & S. Vossne: 2003, Performance of biocide-free antifouling parts - trials on sea-see onto vessels, Vol. 18: Inspections and new applications of 2002 and 2003 and synoptical evaluation of results 1996 - 2003, Lindekor, Hamburg, 125p.



**Acknowledgements**  
The authors are grateful to the German Federal Ministry for Economic Affairs and Energy for providing financial support to R&D Project.

BasaltFaserFlock (Grant Agreement No. 035X410)

Projekt:



Gefördert durch:



aufgrund eines Beschlusses  
des Deutschen Bundestages



## Integriertes Beschichtungs- und Reinigungskonzept zur Bewuchskontrolle an Offshore-Strukturen



**DR. BRILL + PARTNER**  
INSTITUT FÜR ANTIPOULING UND BIOKORROSION

**ROBUST**

## Teilprojekt

# Wirksamkeitsprüfungen der entwickelten reinigungsfähigen Hartbeschichtungen mit Antihafteffekt



Stufe 1: Schwamm (gelbe Seite)

Stufe 2: Weiche Bürste

Stufe 3: Mittelharte Bürste

Stufe 4: Harte Bürste

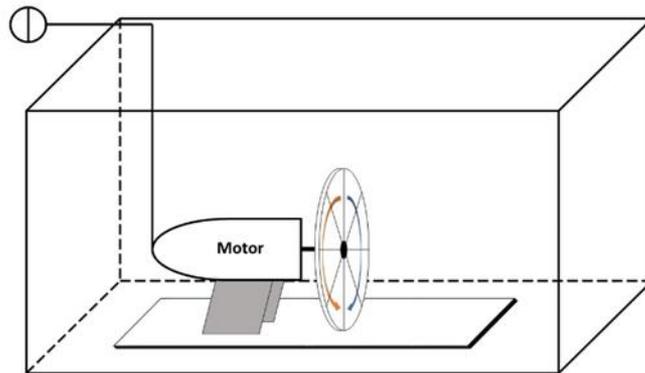
## Geplantes Projekt Haptocheck



„Entwicklung eines standardisierten Prüfverfahrens zur Bewertung der Antihafteigenschaften von Oberflächen gegenüber Biofilmen auf Schiffsrümpfen“



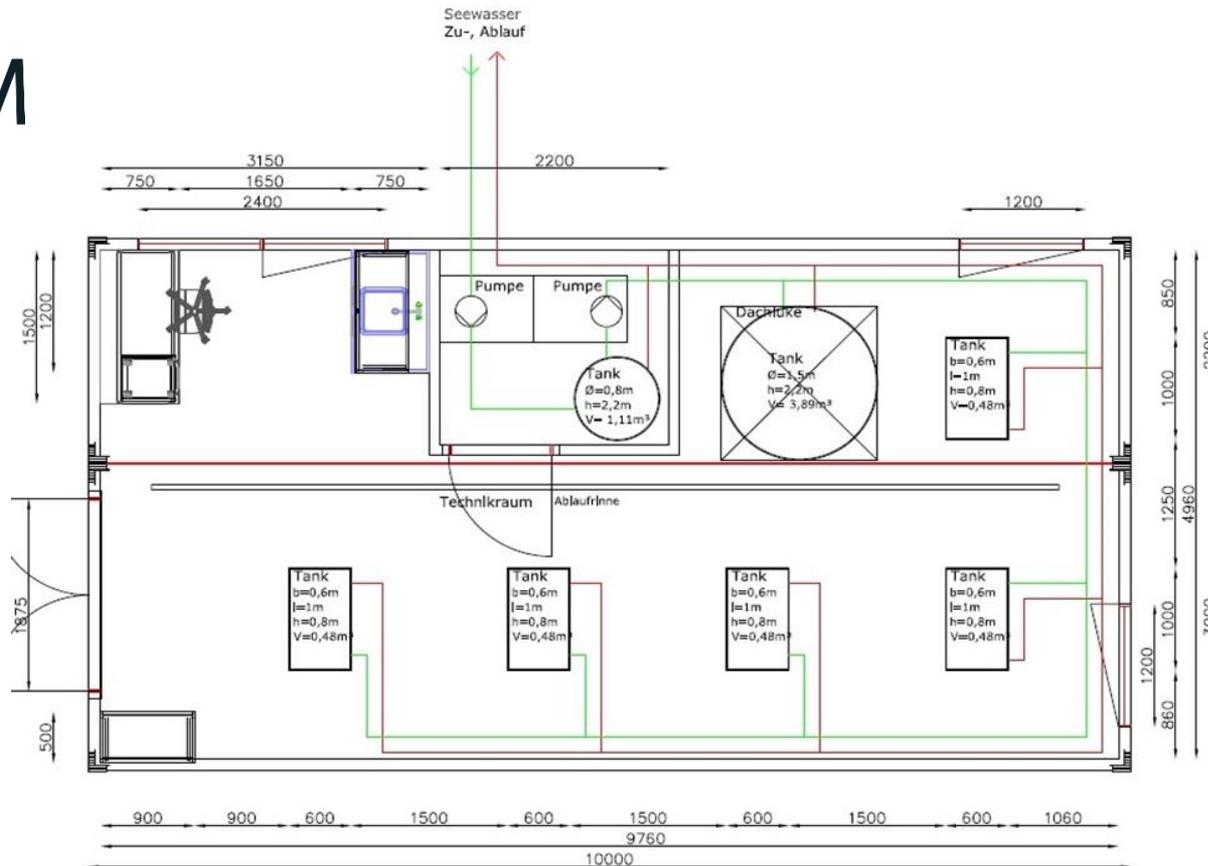
**DR. BRILL + PARTNER**  
INSTITUT FÜR ANTIFOULING UND BIOKORROSION



Entwicklung, Testung und Validierung einer Modelsubstanz mit den Haftungseigenschaften natürlicher Biofilme

# In Planung und Umsetzung: Forschungscontainer in Kooperation mit der Bundesanstalt für Materialforschung und -prüfung BAM

## Fragestellung: Einfluss von Bewuchs auf Korrosion



BAM-Container

**Vielen Dank für's Zusehen ;- ) und Zuhören !**

